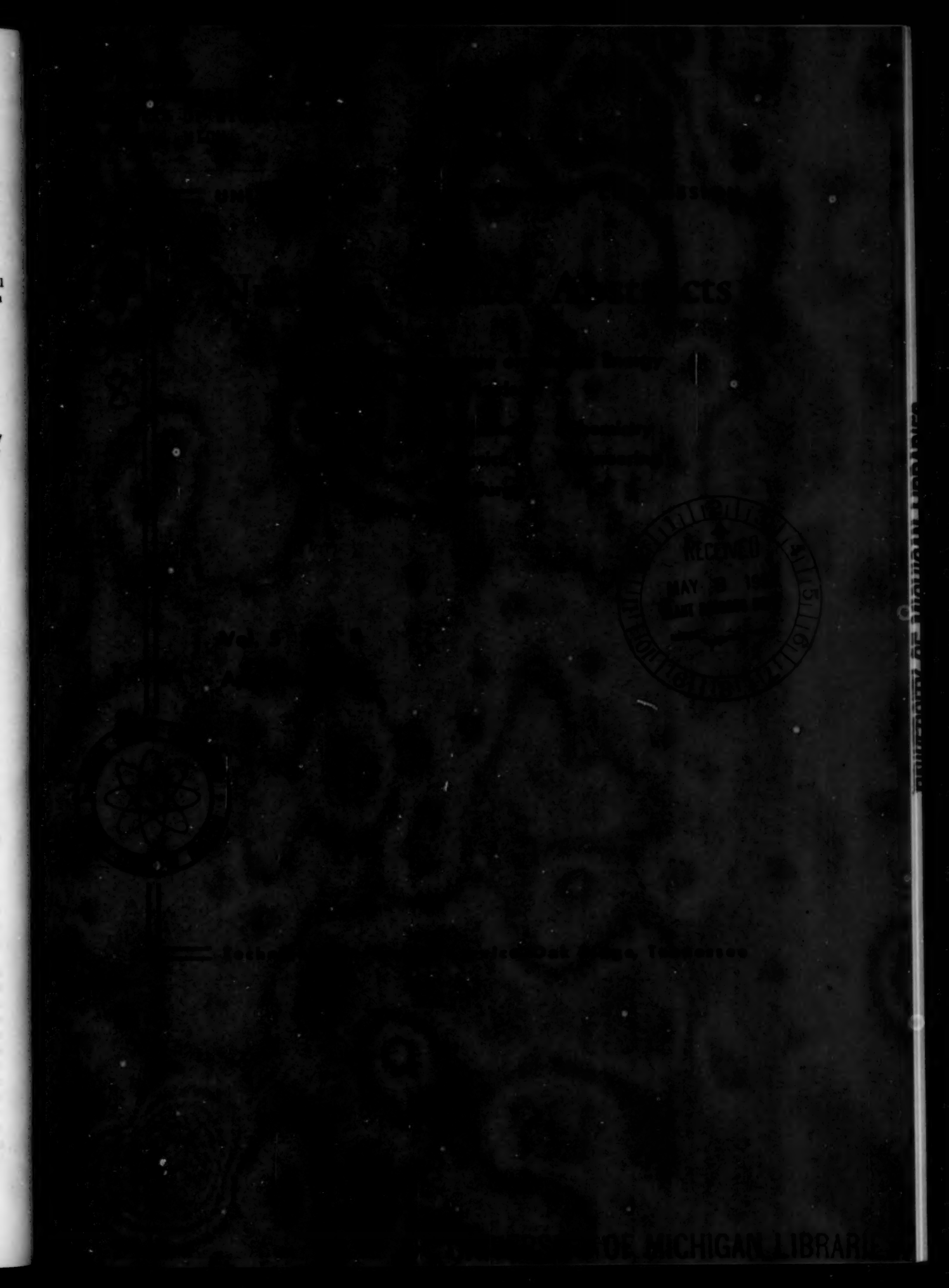

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ERRATA

NSA, Vol. 1, No. 6, p.311. In abstract 1028, line 7, change (−3.0 ± 1.8) to (−1.5 ± 0.9).

NSA, Vol. 3, No. 5, p.280. In abstract 1161, line 5, change (+1.375 ± 0.053) to (+0.69 ± 0.03).

NSA, Vol. 4, No. 24B. On page 1213, erase 265 at bottom of first column; change (UCRL-378) at top of second column to 265. On page 1214, change the AECU number following 333 from 344 to 334.

NSA, Vol. 5, No. 1. On page 30, change pagination in journal reference of abstract 210 from 343-5 to 345-7.

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U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED REPORTS

Report	Title, Author	Abstract
AECD-2957	An Approximate Crystal Structure for the Beta Phase of Uranium. Charles W. Tucker, Jr.	1806
AECD-3010	An X-Ray Spectrometer for Use in Radioactivity Measurements, the L X-Rays of Neptunium and Plutonium; Part B. Some Lighter Isotopes of Astatine. G. W. Barton.	1970
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AECD-3021	The Structure of Thorium Dicarbide by X-Ray and Neutron Diffraction. Elton B. Hunt and R. E. Rundle.	1807
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AECD-3027	Studies on the Electrolytic Reduction of Nitric Acid. Walter J. Hamer.	1792
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AECD-3030	Performance of Liquid-Liquid Extraction Equipment. Barney Rubin and Hugh R. Lehman.	1823
AECD-3031	Acid Fume Scrubber for Steam Vacuum Jet. R. L. Bates.	1879
AECD-3032	A Fluorometric Method for the Determination of Uranium. Edward N. Wise.	1799
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AECD-3035	The Radiations of Ce^{141} and Pa^{233}. M. S. Freedman and D. W. Engelkemeir.	1973

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AECU-988	Cathode-Follower Fallacies. Paul I. Richards.	1880
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AECU-1020	Bibliography; Radiation Protection of Personnel and Radiochemical Laboratories; Their Design and Operation. Eunice Whittlesey and Eloise Givens.	1754

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AECU-1045	The Identification and Relative Distribution of the Metabolites of Radioactive Nicotinic Acid and Nicotinamide. Edgar Leifer, Lloyd J. Roth, David S. Hogness, and Marion H. Corson.	1781
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AECU-1053	General Theory of Cascade Showers. (abstract) W. T. Scott.	1960
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AECU-1056	Gamma-Radiation from Pb^{206}. D. E. Alburger, and G. Friedlander.	1974
AECU-1058	Phosphate Transport and Turnover in the Brain. Jacob Sacks and George G. Culbreth.	1782
AECU-1059	Reflection of Neutrons from Magnetized Mirrors. D. J. Hughes and M. T. Burgy.	1921
AECU-1063	Electron Loading in Ion Accelerating Tubes. I. (abstract) C. M. Turner.	1951
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AECU-1069	Some Observations on Continuously Sensitive Diffusion Cloud Chambers. E. C. Fowler, W. B. Fowler, G. John, D. H. Miller, R. P. Shutt, and A. M. Thorndike.	1895
AECU-1085	The Plastic Behavior of Silver Single Crystals at Various Temperatures. F. D. Rosi.	1844
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AECU-1089	The Brookhaven Nuclear Reactor. Lyle B. Borst.	1938
AECU-1092	Activation Cross Sections Measured with Antimony-Beryllium Photoneutrons. Virginia Hummel and Bernard Hamermesh.	1942
AECU-1093	A Theoretical Discussion of Diffusion Cloud Chambers. (abstract) R. P. Shutt.	1896
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AECU-1098	Mechanical Stage Accessory for Counting Recoil Tracks in Nuclear Emulsions. Richard C. Roth.	1882
AECU-1100	A High-Precision Semi-Micro Automatic Titrator. Edward N. Wise.	1818
ANL-4451	Biological and Medical Divisions Quarterly Progress Report February, March, April, 1950. Austin M. Brues, ed.	1707
ANL-4451(p.15)	Progress Report; Determination of the LD_{50} by Use of Probit, Angular, and Logit Transformations (abstract), p.15 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. S. A. Tyler and Joan Gurian.	1710

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ANL-4451(p.16-21)	Progress Report; A Comparative Study of the Time Patterns of Sr^{89} Excretion Characterizing Various Laboratory Animals, p.16-21 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. S. A. Tyler and Joan Gurian.	1783
ANL-4451(p.22-9)	Progress Report; Spleen-Shielding Experiments, p.22-9 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. L. O. Jacobson, E. L. Simmons, Edna K. Marks, Melba J. Robson, Evelyn O. Gaston, and W. F. Bethard.	1711
ANL-4451(p.30-1)	Modification of Lead Shields for Protection of the Spleen and Appendix During Total-Body X Irradiation (abstract), p.30-1 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. Edna K. Marks.	1712
ANL-4451(p.32-5)	Preliminary Report; The Effect of Spleen and Appendix Protection on the Shwartzman Reaction, p.32-5 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. M. O. Goldman, L. O. Jacobson, and Melba J. Robson.	1713
ANL-4451(p.36-8)	Progress Report; Effect of Spleen Protection During X Irradiation, p.36-8 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. E. Lorenz, L. O. Jacobson, Delta Uphoff, Harriet Sutton, and R. Schweisthal.	1714
ANL-4451(p.39-41)	Preliminary Report; The Value of Mouse Testes for Biological Dosimetry of Ionizing Radiations, p.39-41 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. A. B. Eschenbrenner, T. Wang, and Eliza Miller.	1715
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ANL-4451(p.47-9)	Progress Report; Effect of Irradiation on a Transplantable Mouse Lymphosarcoma, p.47-9 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. Joanne Holicroft and E. Lorenz.	1717
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ANL-4451(p.53-6)	Progress Report; The Effect of Anoxia upon the Survival of Adult Frogs and Day-Old Rats, p.53-6 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. D. E. Smith, H. M. Patt, and Ella B. Tyree.	1719
ANL-4451(p.57-8)	Projected Radiotoxicity Experiments, p.57-8 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. A. M. Brues, R. J. Hasterlik, Miriam P. Finkel, W. P. Norris, W. E. Kisieleski, and J. Schubert.	1777
ANL-4451(p.59-62)	Preliminary Report; Simultaneous Determination of Total Carbon and $Carbon^{14}$ in Single Samples, p.59-62 of Biological and Medical Quarterly Report February, March, April, 1950. D. L. Buchanan.	1800

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ANL-4451(p.63-5)	Progress Report; Further Studies on the Protection of Cells in Vitro from X-Irradiation Damage by SH Compounds, p.63-5 of Biological and Medical Divisions Quarterly Report, February, March, April, 1950. B. V. Hall.	1720
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ANL-4451(p.75-6)	Preliminary Report; Radiation Effects from Diffuse and Point Sources, p.75-6 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. Janet Passonneau and Katherine Hamilton.	1722
ANL-4451(p.77-8)	Progress Report; Effect of X Irradiation on Blood Uric Acid in the Chick, p.77-8 of Biological and Medical Quarterly Report February, March, April, 1950. S. Phyllis Stearner, Emily J. B. Christian, and A. M. Brues.	1723
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ANL-4451(p.93-4)	Progress Report; Method for Embedding Hard Materials, p.93-4 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. James S. Arnold.	1762
ANL-4451(p.95-6)	The Effect of X Irradiation on Some Physico-Chemical Properties of Proteins (abstract), p.95-6 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. E. S. G. Barron, Veronica Bonzell, Betty Gasvoda, and Louise Seki.	1821
ANL-4451(p.97-8)	The Respiration and Acetate Oxidation Rate of X-Irradiated Bacteria (Mycobacterium creatinovorans) (abstract), p.97-8 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. E. S. G. Barron, Veronica Bonzell, Betty Gasvoda, and Louise Seki.	1726
ANL-4451(p.99-100)	Progress Report; Physiological Studies with Mating Reactions in Paramecium bursaria; I. Some Indications for an Action Spectrum in the Mating Reaction, p.99-100 of Biological and Medical Divisions Quarterly Report February. March, April, 1950. C. F. Ehret.	1727

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ANL-4451(p.101)	Progress Report; Physiological Studies on the Mating Reactions in Paramecium bursaria; II. Effect of X Rays on the Mating Reactions, p. 101 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. C. F. Ehret.	1728
ANL-4451(p.102-5)	Progress Report; Radiobiochemistry, p.102-5 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. J. Schubert and Marcia R. White.	1708
ANL-4451(p.106-8)	Preliminary Report; A Quantitative Test of Radiobiological Additivity of Fast Neutrons and Gamma Rays, p.106-8 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. H. H. Vogel, Jr., R. E. Zirkle, and A. M. Brues.	1729
ANL-4451(p.109)	Fecal and Urinary Response to Cholera Vaccine in X-Irradiated Guinea Pigs, p.109 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. W. Burrows, Norma G. Deupree, and Dorothy E. Moore.	1730
ANL-4451(p.110)	Experimental Enteric Cholera in the X-Irradiated Guinea Pig (abstract), p.110 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. W. Burrows, Norma G. Deupree, and Dorothy E. Moore.	1731
ANL-4451(p.111-17)	The Effect of Tritium (H^3) on Cells Cultivated in Vitro, p.111-17 of Biological and Medical Divisions Quarterly Report February, March, April, 1950. Agnes N. Stroud and A. M. Brues.	1732
BNL-84	Guide to Russian Scientific Periodical Literature. John Turkevich and Ludmila Turkevich.	1867
COO-23	A Brief Review of the Literature on Boiling Heat Transfer. G. A. Hawkins.	1837
K-707	The Preparation of Carbonyl Fluoride. A. V. Faloon and W. B. Kenna.	1813
LA-1129	The Use of Uranium as a Pump for Hydrogen. R. C. Cornelius and S. E. Stephanou.	1883
LA-1136	K-Factor Fission Chamber. John H. Larkins.	1884
MITG-259	A Circuit for the Automatic Control of Counting Rate Meters. James H. Pannell and Thomas J. Morrison.	1899
NYO-1534	Some Techniques or Equipment for Trace Quantity Sampling of Industrial Aerosols. W. B. Harris and H. D. Levine.	1836
ORNL-784	Neutron Age Measurements in Graphite with Gold Resonance Detection. W. L. Carlson.	1922
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TID-235	Nuclear Data for Low Power Research Reactors. Office of Classification, AEC.	1923
UCRL-667(Rev.)	Observations on Lithium and Berylium Nuclei Ejected from Heavy Nuclei by High Energy Particles. Luis Marquez and I. Perlman.	1943
UCRL-767	Summary of the Research Progress Meeting of June 1, 1950. R. K. Wakerling.	1852
UCRL-787	Summary of the Research Progress Meeting of June 15, 1950. Henry P. Kramer.	1853

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UCRL-856(Rev.)	The Analysis of π-Meson Production in Nucleon-Nucleon Collisions. Kenneth M. Watson and Keith A. Brueckner.	1915
UCRL-859	Summary of the Research Progress Meeting of July 13, 1950. Henry P. Kramer.	1733
UCRL-890	Summary of the Research Progress Meeting of May 25, 1950. Henry P. Kramer.	1961
UCRL-945	Summary of the Research Progress Meeting of Sept. 29, 1950. Henry P. Kramer.	1854
UCRL-960(Excerpt)	A Study of the Metabolism of Radioactive Calcium (Ca^{45}) in Young, Adult, and Rachitic Rats. D. M. Thomson and D. Harold Copp.	1786
UCRL-964	Summary of the Research Progress Meeting of October 5, 1950. Henry P. Kramer.	1734
UCRL-973	Decay Scheme of Mo^{99}. (abstract) H. Medicus, D. Maeder, and H. Schneider.	1975
UCRL-992	The Preparation of a Lithium Deuteride Casting and Some Properties of Lithium Deuteride. Raleigh L. McKisson.	1811
UCRL-1004	The r-Unit at 320 and 160 Mev. Edwin M. McMillan, Wade Blocker, and Robert W. Kenney.	1900
UCRL-1010	Summary of the Research Progress Meeting of November 9, 1950. Henry P. Kramer.	1855
UR-123	The Pathological Changes Exhibited by Animals Exposed to Single Doses of X-Radiations. R. G. Metcalf, R. J. Blandau, and T. B. Barnett.	1735
UR-136	Some Observations on the Dynamics of Calcification. Harold C. Hodge.	1709
Y-694	Investigation of Failure of Type 347 Stainless Steel Tank for Lithium. F. J. Lambert and Charles Coughlen.	1846

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AERE-TRE-Memo-G/M-110	Calculation of Betatron Orbit Contraction from the Magnetic Characteristics of Betatron Bar Materials. J. J. Wilkins.	1953
BR-454A	The Complex between $U(SO_4)_2$ and HF. Evidence for Its Existence and Instability. (Dekyl Fluoride, Miscellaneous Note 39.) G. O. Morris.	1835
CEA-42	A Mass Spectrometer for the Rapid Analysis of Gaseous Mixtures. C. Cassignol, Y. Ortel, and J. Taieb.	1891
CEA-46	Current Regulator for Stabilizing Electrostatic Generators. (In French) A. Gabet and J. Taieb.	1954
CRE-449	Isotopic Analysis of Deuterium Oxide by Density Determinations. I. A. W. Morrison, B. Smith, and R. Walsh.	1803
CRL-AE-60	The Analysis of Mixtures Containing Tantalum by Measurement of Radioactivity Produced by Neutron Irradiation. J. V. P. Long.	1801
CRL-AE-61	Fundamental Studies on the Precipitation of Uranium and Other Metals from Solutions; Part V. The Hydrolysis and Precipitation of Ferric Iron in Sulphate Solutions. T. V. Arden and Monica Jenkins.	1794

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CRL-AE-62	The Determination of Total Tantalum and Niobium in Minerals and Ores by Solvent Extraction in the Presence of Activated Cellulose. G. A. Wood.	1802
NP-1825	Research in Nuclear Reactions with Fast Alpha Particles, Deuterons, and Neutrons and a Study of the Structure of Complex Nuclei; Final Report. Technical Report No. IV. Purdue Univ.	1930
NP-1861	Final Report on Cladding of Molybdenum to the Rand Corporation. W. L. Bruckart, S. J. Whalen, R. I. Jaffee, and B. W. Gonser.	1849
NP-1879	[Eighteenth Progress Report for the Third Quarter of 1950.] Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.	1926
NP-1889	Particle and Quantum Detectors. R. R. Wilson, D. R. Corson, and C. P. Baker.	1907
NP-1892	Equipment for Radiation Laboratories. General Electric Co.	1819
NP-2191	Investigation in the Field of Complex Fluorides of Tantalum and Columbium; trans. from Zhur. Priklad. Khim. 20, 385 (1947) (In Russian). G. S. Savchenko and I. B. Tananaev.	1825
NP-2221	The Counting Efficiency of Counter Tubes with Aluminum-, Copper- and Gold Cathodes for X-Rays in the Range 5 Kev to 60 Kev; trans. from Helv. Phys. Acta 23, 381-411(1950). Hans Saurer; tr. by Alfred J. Moses.	1901
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GENERAL

ATOMIC POWER

1705

DECLASSIFICATION OF LOW-POWER REACTORS. J. G. Beckerley. Nucleonics 8, No. 1, 13-16(1951) Jan.

Declassification decisions are based primarily on help to us versus help to the "enemy." Complicating such decisions is the complex interrelationship between many items of information, particularly when "facts of nature" are involved. The author, who attended two of the four International Declassification Conferences, describes the philosophy behind the recent changes.

RESEARCH PROGRAMS

1706

AEC CONTRACT POLICY AND OPERATIONS. U. S. Atomic Energy Commission. Washington, U. S. Government Printing Office, January 1951. 158p.

This Ninth Semiannual Report to the Congress gives a summary of the year's program operations insofar as they can be reported within the limits of national security. It provides as well a brief review of the methods which the Commission follows in contracting with industries, research institutions, and with universities and colleges for the carrying on of the many phases of the national atomic energy program. Sections are included on 1950 progress and activities in major programs, AEC contract policy and operations, administration of atomic energy contracts, and the part the AEC plays in contractor labor relations. No new technical data are reported.

BIOLOGY AND MEDICINE

1707

Argonne National Lab.
BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. Austin M. Brues, ed. [nd.] 125p. (ANL-4451)

Separate abstracts have been prepared on the following sections of this report: Progress Report: Determination of the LD_{50} by Use of Probit, Angular, and Logit Transformations (abstract), p.15; Progress Report: A Comparative Study of the Time Patterns of Sr^{89} Excretion Characterizing Various Laboratory Animals, p.16-21; Progress Report: Spleen-Shielding Experiments, p.22-9; Modification of Lead Shields for Protection of the Spleen and Appendix During Total-Body X Irradiation (abstract), p. 30-1; Preliminary Report: The Effect of Spleen and Appendix Protection on the Shwartzman Reaction, p.32-5; Progress Report: Effect of Spleen Protection During X Irradiation, p.36-8; Preliminary Report: The Value of Mouse Testes for Biological Dosimetry of Ionizing Radiations, p.39-41; Quantitative Histologic Analysis of the Testes of Mice Following a Single Total-Body Exposure to X Rays (abstract), p.42-6; Progress Report: Effect of Irradiation on a Transplantable Mouse Lymphosarcoma, p.47-9; Progress Report: The 30-day LD_{50} for Hybrid Guinea Pigs, p.50-2; Progress Report: The Effect of Anoxia upon the Survival of Adult Frogs and Day-Old Rats, p.53-6; Projected Radiotoxicity Experiment, p.57-8; Preliminary Report: Simultaneous Determination of Total Carbon and $Carbon^{14}$ in Single Samples, p.59-62; Progress Report: Further Studies on the Protection of Cells in Vitro from X-Irradiation Damage by SH Compounds, p.63-5; Progress Report: Comparison of the Effects of Irradiation in Vitro with Tritium and X Rays on the Growth and Survival of Mouse-Tumor Implants, p.66-74; Preliminary Report: Radiation Effects from Diffuse and Point Sources, p.75-6; Progress Report: Effect of X Irradiation on Blood Uric Acid in the Chick, p.77-8; Progress Report: Nucleic Acid Metabolism in Chilomonas paramecium, p.79-81; The Actuarial Calculus of Chronic Radiation Lethality (abstract), p.82-3; Progress Report: Radiobiology Experiment Station, p.84-9; Determination of Coincidence Errors in Geiger Tubes (abstract), p.90-1; Progress Report: Effects of X Radiation on Solutions Containing Organic Stable Free Radicals, p.92; Progress Report: Method for Embedding Hard Materials, p.93-4; The Effects of X Irradiation on Some Physico-Chemical Properties of Proteins (abstract), p.95-6; The Respiration and Acetate Oxidation Rate of X-Irradiated Bacteria (Mycobacterium creatinovorans) (abstract), p.97-8; Progress Report: Physiological Studies on the Mating Reaction in Paramecium bursaria. I. Some Indications for an Action Spectrum in the Mating Reaction, p.99-100; Progress Report: Physiological Studies on the Mating Reaction in Paramecium bursaria. II. Effect of X Rays on the Mating Reaction, p.101; Progress Report: Radiobiochemistry, p.102-5; Preliminary Report: A Quantitative Test of Radiobiological Additivity of Fast Neutrons and Gamma Rays, p.106-8; Fecal and Urinary Response to Cholera Vaccine in X-Ir-

radiated Guinea Pigs (abstract), p.109; Experimental Enteric Cholera in the X-Irradiated Guinea Pig (abstract), p.110; The Effect of Tritium (H^3) on Cells Cultivated in Vitro, p.111-17.

1708

Argonne National Lab.
PROGRESS REPORT; RADIOBIOCHEMISTRY, p.102-5 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. J. Schubert and Marcia R. White. [nd.] 4p. (ANL-4451(p.102-5))

Complex-ion Studies. Association constants of the complexes of Ca^{++} and Sr^{++} with citric, tricarballylic, tartaric, succinic, malic, malonic, maleic, and citraconic acids have been measured with tracer Ca^{45} and $Sr^{89,90}$.

Treatment of Radiation Sickness. A series of compounds, each of which is known to act upon specific stages in certain metabolic processes, has been selected for injection into irradiated animals. It is hoped that by their interference in certain biochemical processes these compounds will inhibit or enhance radiation effects. The results to date with copper gluconate, sodium orthovanadate, sodium fluoroacetate, malononitrile, sodium iodoacetate, disodium malonate, and manganous gluconate are summarized.

Treatment of Radioelement Poisoning. Recent studies of the effects of Zr citrate on the tissue distribution of Pu are summarized. A more detailed report is being prepared.

1709

Atomic Energy Project, Univ. of Rochester
SOME OBSERVATIONS ON THE DYNAMICS OF CALCIFICATION. Harold C. Hodge. Oct. 11, 1950. 29p. (UR-136)

The idea that secondary calcium phosphate is somehow involved in the calcification process has been presented repeatedly in the literature. A brief review of some of the evidence for and against the importance of this compound in calcification is made. (Compare Huggins, Physiol. Revs. 17, 119(1937) and Sobel, J. Biol. Chem. 158, 475(1945); ibid. 159, 159(1945); ibid. 171, 285(1947).) 24 references.

RADIATION EFFECTS

1710

Argonne National Lab.
PROGRESS REPORT; DETERMINATION OF THE LD_{50} BY USE OF PROBIT, ANGULAR, AND LOGIT TRANSFORMATIONS (abstract), p.15 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. S. A. Tyler and Joan Gurian. [nd.] 1p. (ANL-4451(p.15))

This material appeared as report ANL-4486, which was abstracted in Nuclear Science Abstracts as NSA 4-6017.

1711

Argonne National Lab.
PROGRESS REPORT; SPLEEN-SHIELDING EXPERIMENTS, p.22-9 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. L. O. Jacobson, E. L. Simmons, Edna K. Marks, Melba J. Robson, Evelyn O. Gaston, and W. F. Bethard. [nd.] 8p. (ANL-4451(p.22-9))

Essentially complete regeneration of hematopoietic tissue occurred within 8 days and mortality was strikingly reduced in mice which had the spleen exteriorized and Pb-shielded during total-body exposure to 1025 r of x radiation. Concurrently no anemia and only a transient leucopenia and thrombocytopenia occurred. Mice that were not given such protection during exposure to 1025 r died within 13 days with a severe anemia, leucopenia, and thrombocytopenia, and histologic regeneration of the hematopoietic tissue was absent or inadequate. This phenomenon has been observed in x-irradiated spleen-protected rats and in rabbits that were given spleen or appendix protection. Preliminary data indicate that Pb shielding the kidney of mice has no effect while shielding a lobe of the liver or the larger part of the small intestine hastens hematopoietic recovery after irradiation but not to the degree observed in the spleen-shielding studies. These and other observations indicate that the factor or factors involved in the rapid regeneration of hematopoietic tissue under these circumstances is humoral rather than cellular. In mice which had been spleen-protected during exposure to 1025 r and splenectomized 24 hr afterward there was about 50% survival at 28 days following treatment, and hematopoietic recovery was hastened. Mice which were not spleen-protected during exposure died within 14 days whether or not they were splenectomized 24 hr after irradiation. These observations indicate the rapidity with which the "unknown factor" coming from the spleen effectively enhances recovery. Attempts are being made to determine how soon after Pb shielding the spleen can be removed and still influence survival.

1712

Argonne National Lab.
MODIFICATION OF LEAD SHIELDS FOR PROTECTION OF THE SPLEEN AND APPENDIX DURING TOTAL-BODY X IRRADIATION (abstract), p.30-1 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. Edna K. Marks. [nd.] 2p. (ANL-4451(p.30-1))

This section of the report is reproduced here in its entirety.

In a previous report a description was given of Pb shields used to protect the spleen or appendix of rabbits during total-body x irradiation. Since that time, the shields have been modified. The changes that were made contribute to better protection of the shielded organs and less trauma to the tissues. The spleen shield consists of two parts that fit together by means of overlapping flanges. This arrangement prevents compression of the splenic pedicle and the entrance of x rays. The wall of the shield is ¼ in. thick. The appendix shield is similar to that for the spleen. The larger opening at one end permits the passage of the proximal end of the appendix and the narrow slit, with overlapping flanges, allows the mesentery and blood supply of the appendix to remain intact and prevents the appendix from slipping out of the shield during irradiation.
4 photographs.

1713

Argonne National Lab.
PRELIMINARY REPORT; THE EFFECT OF SPLEEN AND APPENDIX PROTECTION ON THE SHWARTZMAN REACTION, p.32-5 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. M. O. Goldman, L. O. Jacobson, and Melba J. Robson. [nd.] 4p. (ANL-4451(p.32-5))

In rabbits the administration of an intradermal injection of meningococcus endotoxin followed 24 hr later by an intravenous injection of the same material results in a severe hemorrhagic necrotic reaction at the intradermal site within 2 to 6 hr after the second injection. This phenomenon is known as the Shwartzman phenomenon. It may be suppressed by such agents as nitrogen mustard, x rays, and benzol if these are administered in large doses prior to intradermal injection. Experiments are in progress to investigate the possibilities of altering this suppressive action with the view of finding explanations for the Shwartzman phenomenon. It was found that local irradiation (800 r) administered to the skin of rabbits did not suppress the reaction. Data indicate that suppression of this phenomenon by total-body x irradiation is dependent upon some generalized change throughout the body, that Pb protection as such does not alter this condition, but that trauma to the abdominal viscera at the time of irradiation does prevent the full suppressive action.

1714

Argonne National Lab.
PROGRESS REPORT; EFFECT OF SPLEEN PROTECTION DURING X IRRADIATION, p.36-8 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. E. Lorenz, L. O. Jacobson, Delta Uphoff, Harriet Sutton, and R. Schweisthal. [nd.] 3p. (ANL-4451(p.36-8))

Four months after a single total-body exposure to 900 r of radiation, 93% of spleen-protected mice have survived. After an initial weight loss the animals have continued to gain weight, and the blood picture, which returned to normal 2 weeks after exposure, has remained normal. In a study of the effects of spleen protection of mice carrying a transplanted lymphosarcoma in the spleen and given a single total-body exposure to 400 or 900 r of radiation, survival was found to be as follows: controls, 68%; 400 r group, no spleen protection, 85%; 400 r, spleen protection, 50%; and 900 r, spleen protection, 65%. It is believed that the compensatory ectopic blood formation that arises in the Pb-protected spleen following irradiation has little effect on lymphosarcomal transplant. A total dose of 1000 r given in 12 equal treatments resulted in 60% lymphoma incidence in one-month C-57 male mice. The same strain is being used to test the effect of spleen protection on the incidence of radiation-induced lymphoid tumors. Spleen protection of 4-week C-57 mice during irradiation had little effect upon survival. Since the radiosensitivity of these animals seems to be constant for mice at the age of one month or older, an effort was made to determine whether mice of other strains respond in the same way. Four-week spleen-protected strain-A mice were exposed to 800 r. All the exposed animals were dead at 8 days. Autopsy findings indicate that the gastrointestinal tract is more radiosensitive in these young mice than in older animals.

1715

Argonne National Lab.
PRELIMINARY REPORT; THE VALUE OF MOUSE TESTES FOR BIOLOGICAL DOSIMETRY OF IONIZING RADIATIONS, p.39-41 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. A. B. Eschenbrenner, T. Wang, and Eliza Miller. [nd.] 3p. ANL-4451(p.39-41))

Some preliminary observations have been made on the pattern of damage and recovery of the testes of mice exposed to neutron irradiation, and the data have been compared with x-irradiation damage and recovery findings from earlier studies. Mice, confined in plastic cages, were exposed to neutrons of an average energy of 4 to 5 Mev. The cages were located about 60 cm from the target and the maximum γ background of the cyclotron at this distance from the cages was estimated to be about 30% of the total dose. The animals received a total of 29N at about 3N/min. Irradiated and nonirradiated mice were sacrificed and the testes removed at week intervals after exposure. The close similarity of the x-ray and neutron data strongly suggested the same biologic response. This is also true for mice exposed to x rays from a 50-Mev betatron. It appears that the response of the mouse testis to irradiation may prove to be a valuable tool for future studies on the relation between biologic effect and physical dose.

1716

Argonne National Lab.
QUANTITATIVE HISTOLOGIC ANALYSIS OF THE TESTES OF MICE FOLLOWING A SINGLE TOTAL-BODY EXPOSURE TO X RAYS (abstract), p.42-6 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. A. B. Eschenbrenner and Eliza Miller. [nd.] 5p. (ANL-4451(p.42-6))

Groups of LAF_1 male mice were given single total-body exposures to 400 r of radiation. Irradiated and nonirradiated mice were sacrificed and the testes were removed at weekly intervals for 12 weeks after x irradiation. Chalkley's method (J. Natl. Cancer Inst. 4, 47-53(1943)) was used for quantitative analysis of the testes and the various cellular elements were identified according to his criteria. There appeared to be no evidence of morphologic cell death even when the testes' weights were reduced to 40% of normal. The weight decrease was due to a decrease in quantity of the spermatogenic elements, the interstitial tissue and supporting stroma remaining normal in total amounts. This depopulation of spermatogenic elements was due to the radiosensitivity of the spermatogonia. The depopulation was not a result of the destruction of spermatogonia but of the inhibition of mitosis which lasted for a period ranging between 2 and 3 weeks. Mitotic activity of spermatogonia in which they reproduce their own kind is considered to be similar to mitotic activity in somatic cells. If this is true, a similar irradiation effect should be seen in other irradiated somatic cells. Studies are under way to determine this.

1717

Argonne National Lab.
PROGRESS REPORT; EFFECT OF IRRADIATION ON A

TRANSPLANTABLE MOUSE LYMPHOSARCOMA, p.47-9 of BIOLOGICAL AND MEDICAL DIVISIONS, QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. Joanne Hollcroft and E. Lorenz. [nd.] 3p. (ANL-4451(p.47-9))

An effort is being made to determine whether the radiation effect on transplanted mouse lymphosarcoma is direct or indirect (systemic). Data indicate that the systemic effect is due to the general toxic state produced when the tumor and total body are irradiated simultaneously. Spleen protection did not influence tumor regression. Since the systemic effect appears to be due to general toxicity, spleen protection apparently does not reduce this toxic state. Data also indicate that the systemic effects of total-body x irradiation become less and less pronounced as the time interval between the treatment of the whole body only and the tumor only is increased. When the tumor was x irradiated with 400 r 6 to 24 hr after the body has been given 400 r, there was only slight regression. Regression became greater when the time interval was reduced to 4 hr but was not as great as when the tumor and the total body were irradiated at the same time. It is concluded that the systemic effect lasts for only a short time after the simultaneous irradiation of the body and the tumor and may be due to a rapidly disappearing, nonspecific toxic material produced by irradiation.

1718

Argonne National Lab.
PROGRESS REPORT; THE 30-DAY LD_{50} FOR HYBRID GUINEA PIGS, p.50-2 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. E. Lorenz, Delta Uphoff, Harriet Sutton, and R. Schweisthal. [nd.] 3p. (ANL-4451(p.50-2))

In previous experiments designed to determine the 30-day LD_{50} for hybrid guinea pigs, groups of animals were given single total-body exposures to 220, 260, and 310 r of x radiation. This study has been concluded with two additional exposure groups of 360 and 420 r. In the first three groups there was no sex difference in survival, but in the last two groups, the females seemed more radiosensitive than the males. However, this finding is probably due to chance since the experiments were spread over a year and hybrid stock was used. The 30-day LD_{50} is calculated to be 409 r with 2 limits of 307 and 543 r. This value is at variance with previously published data of other investigators, and it is suggested that the low figures reported by these investigators may have been caused by irradiating diseased guinea pigs.

1719

Argonne National Lab.
PROGRESS REPORT; THE EFFECT OF ANOXIA UPON THE SURVIVAL OF ADULT FROGS AND DAY-OLD RATS, p.53-6 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. D. E. Smith, H. M. Patt, and Ella B. Tyree. [nd.] 4p. (ANL-4451(p.53-6))

Pairs of male frogs (Rana pipiens) were exposed to total-body x radiation consisting of single doses of 3000, 6000, or 12,000 r. One of each pair was subjected to anoxia in 100% N_2 during irradiation while the other was irradiated in room air. Daily checks on mortality indicated that subjecting frogs to anoxia during x irradiation does not alter their radiosensitivity as measured by survival. One-day-old Sprague-Dawley rats were given single total-body doses of 500 r in 100% N_2 or in 20% O_2 – 80% N_2. Sixteen of the 17 rats exposed in 100% N_2 were surviving at 20 days post-irradiation, while none of 17 irradiated in the 20% O_2 – 80% N_2 mixture were alive. Death in the control group occurred from the 9th to the 13th days after x irradiation. It appears that the survival of one-day rats is greatly increased by anoxia during irradiation.

1720

Argonne National Lab.
PROGRESS REPORT; FURTHER STUDIES ON THE PROTECTION OF CELLS IN VITRO FROM X-IRRADIATION DAMAGE BY SH COMPOUNDS, p.63-5 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT, FEBRUARY, MARCH, APRIL, 1950. B. V. Hall. [nd.] (ANL-4451(p.63-5))

These studies have been designed to evaluate the importance of extracellular cysteine in the protection of irradiated tumor cells. Mouse tumor fragments weighing 12 to 14 mg were placed in Columbia embryological dishes. To two of the dishes 2 cc of 0.85% NaCl saturated with cystine at 27°C, and to two others 2 cc of 0.85% NaCl containing 0.0079M cysteine, were added. After 20 min the solutions were removed and the fragments were x irradiated with 3000 r (200 kv, 2 mm Al filter). Transplants were made and tumor growth was measured. Data indicate that the protection afforded by cysteine is not due to the presence of cysteine in the surrounding media at the time of irradiation. It is likely that irradiation damage to cells is due in large part to intracellular ionization. The results of this experiment support the conclusion that the protection afforded cells by cysteine is an intracellular phenomenon.

1721

Argonne National Lab.
PROGRESS REPORT; COMPARISON OF THE EFFECTS OF IRRADIATION IN VITRO WITH TRITIUM AND X RAYS ON THE GROWTH AND SURVIVAL OF MOUSE TUMOR IMPLANTS, p.66-74 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. B. V. Hall and Agnes Stroud. [nd.] 9p. (ANL-4451(p.66-74))

These studies have been initiated to investigate the effects of exposure to tritium, in vitro, upon the survival and subsequent growth of mouse tumor fragments, and to compare these effects with those resulting from exposure to equivalent doses of x radiation. The tumor is a rapidly growing anaplastic mouse carcinoma. Pieces ranging between 12 and 14 mg were irradiated with tritium β rays or x rays. Tritium concentrations varied from 500 to 31.25 mc/cc, and the tissues were kept in these solutions for 90 min at 28°C. X rays were administered at a rate of 1028 to 1072 r per min (200-kv machine, 15 ma). The tumor pieces were then transplanted. The hosts were weighed each week, and the tumors were measured. Exposure to cumulative dosages of H^3 of 5425 re equiv or more was lethal. The LD_{50} appeared to be about 2500 re. The lethal dose of x rays was 4000 r, while the LD_{50} was about 3000 r. At lower dosages H^3 appeared to be somewhat more effective in retarding growth

and in killing the tumor fragments than were similar dosages of x ray, but above the LD_{50}, x rays seemed more effective. This may be due to marked differences in dose rate. In general, it may be concluded that the effects of equivalent dosages of ionizing radiation from β particles resulting from H^3 decay, calculated as roentgen equivalents, and x-ray roentgens from a 200-kv machine have similar effects on the growth and survival of mouse tumor fragments.

1722

Argonne National Lab.
PRELIMINARY REPORT; RADIATION EFFECTS FROM DIFFUSE AND POINT SOURCES, p.75-6 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. Janet Passonneau and Katherine Hamilton. [nd.] 2p. (ANL-4451(p.75-6))

Experiments are in progress to compare radiation effects from diffuse and point sources. In the first experiment, CF-1 mice were exposed to soft x rays (50 kv, 40 ma, target distance 10 cm, no filter). Three groups of mice in each series were irradiated in such a way that the area of skin exposed varied inversely with the dosage. One series was irradiated on the dorsal surface and one series on the ventral surface. During the 15 weeks following irradiation treatment, site areas have epilated but no abnormal growth has been seen. A second experiment is in preparation in which β radiation effects from diffuse and point sources of Sr^{90} will be compared. Blotting paper soaked in Sr^{90} provides the diffuse sources, and glass beads containing Sr^{90} provide the point sources. Epilation-producing doses will be given to Sprague-Dawley rats from a diffuse source, and from 10, 20, and 50 bead sources.

1723

Argonne National Lab.
PROGRESS REPORT; EFFECT OF X IRRADIATION ON BLOOD URIC ACID IN THE CHICK, p.77-8 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. S. Phyllis Stearner, Emily J. B. Christian, and A. M. Brues. [nd.] 2p. (ANL-4451(p.77-8))

Determinations of blood uric acid concentration have shown that in the chicken a marked increase occurred within 3 to 5 hr after exposure to 1000 r at 43 r/min. Similar results were found on newly hatched and one-month chicks. Uric acid and its salts, the primary end products of protein metabolism in birds, are relatively insoluble, and, in animals dying within 1 to 2 days after exposure, precipitated urates were found around the kidney tubules, on the visceral surfaces, etc. Exposure to the same total dosage at 6 r/min resulted in only a slight increase in the concentration of blood uric acid. It is hoped that the results of renal function tests, now under way, will indicate whether the increased blood uric acid level is due to failure of renal function or to an increase in rate of nitrogen metabolism associated with a normal excretory rate.

1724

Argonne National Lab.
PROGRESS REPORT; NUCLEIC ACID METABOLISM IN CHILOMONAS PARAMECIUM, p.79-81 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. H. S. Ducoff. [nd.] 3p. (ANL-4451(p.79-81))

An investigation has been instituted to study the effects of radiation on nucleic acid synthesis and turnover of individual nucleotides. In preparation for these studies a comparison has been made of several methods of extraction of Chilomonas paramecium ribonucleotides, prior to separation on ion-exchange columns. The Schmidt-Thannhauser method appears preferable to the other isolation procedures tested. A method is being developed to achieve greater polulation densities by culturing the protozoa in dialysis bags suspended in a large volume of culture solution.

1725

Argonne National Lab.
THE ACTUARIAL CALCULUS OF CHRONIC RADIATION LETHALITY (abstract), p.82-3 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. George A. Sacher. [nd.] 2p. (ANL-4451(p.82-3))

The logarithm of the rate of mortality (Gompertz function) is (except for a short period after birth) approximately a linearly increasing function of age for all species of mammals investigated and for many other metazoan forms. If the Gompertz function is a linear function of age, all the commonly used actuarial functions can be evaluated explicitly. A simplified picture of the effect of exposure to radiations on the Gompertz function is presented. The effect of single exposure may be described as consisting primarily of a displacement upward of the Gompertz function without change in slope, while the effect of duration of-life exposure is to increase the slope of the Gompertz function subsequent to exposure. These effects have been confirmed in investigations on populations of mice and drosophila images. Various consequences of this schema with respect to effects of a single dose at a given age, continuous exposure, and specie difference are presented.

1726

Argonne National Lab.
THE RESPIRATION AND ACETATE OXIDATION RATE OF X-IRRADIATED BACTERIA (MYCOBACTERIUM CREATINOVORANS) (abstract), p.97-8 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. E. S. G. Barron, Veronica Bonzell, Betty Gasvoda, and Louise Seki. [nd.] 2p. (ANL-4451 (p.97-8))

It was shown previously (ANL-4291) that x irradiation of Mycobacterium creatinovorans with doses varying from 1000 to 10,000 r, caused an increasing inhibition of respiration of the bacteria irradiated in the culture media containing acetate. On irradiation of three-times washed bacteria the residual respiration was unaffected by 6000 r while respiration in the presence of acetate was 30% inhibited. To determine whether permanent changes could be produced in bacteria by continuous irradiation with relatively small doses of x rays, liquid cultures of M. creatinovorans (in acetate medium) were irradiated with 1000 r. One-day-old cultures were irradiated in test tubes with

1000 r (effective irradiation about 800 r); the cultures were transplanted 8 hr later into another test tube which was irradiated on the following morning. The total amount of effective radiation was 11,200 r. The residual respiration, as well as the oxidation rate of acetate, was depressed in the x-irradiated bacteria. Pigment formation in the x-irradiated bacteria was also less than in the control samples. The x-ray dose received daily, 800 r, when given in a single dose had no effect either on multiplication of bacteria or on respiration.

1727

Argonne National Lab.
PROGRESS REPORT; PHYSIOLOGICAL STUDIES ON THE MATING REACTION IN PARAMECIUM BURSARIA; I. SOME INDICATIONS FOR AN ACTION SPECTRUM IN THE MATING REACTION, p.99-100 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. C. F. Ehret. [nd.] 2p. (ANL-4451(p.99-100))

Early in the light period the mating reaction magnitude was increased by at least 20% in all spectral regions investigated, within the range from 350 to 650 mμ as obtainable with glass and $CuCl_2$ filter combinations. The blue-violet region (450 mμ peak) was more effective by about 50% than longer wavelengths. Late in the light period, equivalent energies of the total visible spectrum or of the longer (orange-red) wavelengths inhibit the reaction magnitude whereas blue-violet light causes an increase by 15 to 50%. The action spectrum will be determined with monochromatic light.

1728

Argonne National Lab.
PROGRESS REPORT; PHYSIOLOGICAL STUDIES ON THE MATING REACTION IN PARAMECIUM BURSARIA; II. EFFECT OF X RAYS ON THE MATING REACTION, p.101 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. C. F. Ehret. [nd.] 1p. (ANL-4451(p.101))

During the light period, a stimulatory effect of x rays on the reaction magnitude was observed below 10,000 r. This effect was proportional to the dose, with a maximum at 8000 r. At 8000 r the reaction magnitude was 235% that of the nonirradiated controls. Above 10,000 r there was dose-dependent decrease, equal at 40,000 r to 8% of the nonirradiated controls. No such reactions were observed during the dark period.

1729

Argonne National Lab.
PRELIMINARY REPORT; A QUANTITATIVE TEST OF RADIOBIOLOGICAL ADDITIVITY OF FAST NEUTRONS AND GAMMA RAYS, p.106-8 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. H. H. Vogels, Jr., R. E. Zirkle, and A. M. Brues. [nd.] 3p. (ANL-4451(p.106-8))

The first experiments planned for the neutron program have been devised to test the radiobiological additivity of fast neutrons and γ rays in their acute lethal action on mice. It is planned specifically to use dose rates which will deliver the 30-day LD_{50} in approximately 1, 6, and 24 hr. Data will be obtained for three survival curves: one for fast neutrons, one for γ rays, and one for the two radiations combined in approximately equal radiobiological intensity. At least 9000 mice will be used in these experiments. The source of fast neutrons will be a converter consisting of a horizontal layer of natural U about 1 in. thick and 30 in. square. This, when in use, will be centered on the vertical axis of the thermal column. At least 50 mice will be irradiated simultaneously in the animal chamber. Since the γ rays produced with fission cannot be measured satisfactorily in the presence of fast neutrons and are not of sufficient radiobiological intensity to match the effectiveness of the neutrons, it is proposed to use γ sources of Co^{60}. Thus the mice can be exposed to γ rays alone (with the pile not in operation); they can be exposed solely to fast neutrons from the U converter (with the pile in operation, but the Co^{60} source removed from its position above the animal chamber); or the mice can be irradiated simultaneously with γ rays from above and fast neutrons from below.

1730

Argonne National Lab.
FECAL AND URINARY RESPONSE TO CHOLERA VACCINE IN X-IRRADIATED GUINEA PIGS, p.109 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. W. Burrows, Norma G. Deupree, and Dorothy E. Moore. [nd.] 1p. (ANL-4451 (p.109))

This section of the report is reproduced here in its entirety.

The effect of pre- and postimmunization x irradiation in dosages ranging from 50 to 200 r on the immune response of guinea pigs to cholera O vaccine was assayed as serum, fecal, and urinary antibody (agglutinin). X irradiation following immunization did not appreciably affect serum antibody titer, but dosages of 100 and 150 r partially or completely inhibited the excretion of fecal and urinary antibody. Excretion could be partially restored by booster inoculation. Preimmunization irradiation sharply reduced serum antibody titer, but produced a transitory stimulus of fecal and urinary antibody, apparent when immunization was begun at one day, but not 3 days, after x irradiation.

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Argonne National Lab.
EXPERIMENTAL ENTERIC CHOLERA IN THE X-IRRADIATED GUINEA PIG (abstract), p.110 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. W. Burrows, Norma G. Deupree, and Dorothy E. Moore. [nd.] 1p. (ANL-4451 (p.110))

This section of the report is reproduced here in its entirety.

The effect of x irradiation in single total-body dosages of 100 or 200 r on enteric cholera in guinea pigs was assayed by autopsy culture of animals sacrificed at intervals after irradiation and by the number of vibrios and titer of antibody excreted in the feces. In the 63% of the animals that died after exposure to 150 r, death was associated with generalized bacterial infection. Cholera vibrios were found in 44% of these animals and hemolytic streptococci and

staphylococci were found in the remainder. Thus, at this dosage there resulted a generalized tissue invasion of cholera vibrio from a focus of infection in the bowel which was not found in infected, nonirradiated animals. With dosages of 150 and 200 r the intensity of the infection was reduced during the first three days following inoculation concurrent with that of antibody response, but subsequently the antibody titer decline and the infection increased. While the infection was appreciably reduced in intensity in its early stages by dosages of 100 r, coproantibody response was not effectively inhibited, and both intensity and duration of the infection were reduced compared with that in the nonirradiated animal. The inverse relation between coproantibody titer and the intensity and tendency to generalization of the enteric infection provides additional support for the hypothesis that effective immunity to enteric infection is in part a function of coproantibody. If it is assumed that natural immunity to bacteria of intestinal flora is also related to coproantibody response, the inhibition of this immune response by lethal dosages of x radiation may account for bacteremia of intestinal origin in irradiation sickness.

1732

Argonne National Lab.
THE EFFECT OF TRITIUM (H^3) ON CELLS CULTIVATED IN VITRO, p.111-17 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. Agnes N. Stroud and A. M. Brues. [nd.] 7p. (ANL-4451(p.111-17))

A series of cultures of chick embryo muscle was treated with H_2^3O at dosage rates of 41.5 to 3000 rep/hr, up to total dosages of 72,000 rep. Under continuous irradiation, completion of the mitotic cycle becomes very much delayed even after the accumulation of a few hundred rep. Not all mitoses are equally delayed at a given stage, and the delay appears to result from a variety of processes, perhaps related to abnormal nucleic acid metabolism. Some cells eventually divide unequally, without evidence of spindle or plate formation. Delay may occur in any stage of mitosis, perhaps excepting prophase. Cell degeneration occurs only in dividing cells at the lower dosages; after 20,000 rep and more, degeneration occurs suddenly in resting cells, beginning with an "explosion" followed by shrinkage of the nucleus. Others degenerate without exploding. Preliminary data suggest that at a given dose rate, the onset of mitosis is suppressed partially, an equilibrium rate of cell division being attained. Due to concomitant delays in completion of the cycle it is impossible to measure directly partial inhibition of onset. The cytoplasmic behavior of continuously irradiated cells is described.

1733

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF JULY 13, 1950. Henry P. Kramer. Oct. 24, 1950. 12p. (UCRL-859)

Effects of Radiation on Bacteria. E. coli, after exposure to bombardment by neutrons, accelerated deuterons, and α particles, were incubated and surviving visible bacterial colonies were counted. It was found that the destructive effect of a certain dosage due to energetic particles is less than that due to less energetic particles. The cross section exposed to the beam of the sensitive volume was found to vary with energy.

Energy Distribution of Cyclotron Beam in Targets. The use of data, obtained previously, in the formulation of preliminary estimates (graphic) of the energy distribution, in targets, of protons which had been accelerated by the cyclotron to 350 Mev is reported.

Study of Excited States in Be^7 Using the Li Technique. Using a technique based on the reaction $Li^6(n,\alpha)H^3$ (described in UCRL-790) the possible existence of an excited level in the Be^7 nucleus that remains after the compound nucleus Be^8 has emitted a neutron is reported. Energy levels at 220, 430, and 750 Mev are indicated.

1734

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF OCTOBER 5, 1950. Henry P. Kramer. Oct. 25, 1950 8p. (UCRL-964)

Quantities of labeled Na and K were administered to rats which were then subjected to various doses of radiation. Results indicate that one of the causes of radiation injury is a K deficiency induced in radiation sensitive tissue. References to measuring techniques used in England are included.

1735

Atomic Energy Project, Univ. of Rochester
THE PATHOLOGICAL CHANGES EXHIBITED BY ANIMALS EXPOSED TO SINGLE DOSES OF X-RADIATION. R. G. Metcalf, R. J. Biandau, and T. B. Barnett. July 17, 1950. 44p. (UR-123)

Albino rats were exposed to a single dose of 550 r of whole-body x radiation and were sacrificed at intervals from 15 min to 42 days after exposure. Sections of selected organs were examined microscopically, and studies were done on the peripheral blood and bone marrow and on sperm from the vas deferens. 33 figures. 28 references.

1736

ACUTE INTESTINAL RADIATION DEATH. STUDIES ON ROENTGEN DEATH IN MICE, III. Henry Quastler, Elizabeth F. Lanzl, Mildred E. Keller, and James W. Osborne. Am. J. Physiol. 164, 546-56(1951) Feb.

Mice were subjected to x irradiation, delivered in one or two exposures to the whole body or to parts, and the time elapsing between irradiation and death was recorded. A survival time of 3½ days is stable over a wide range of doses. It occurs with radiation of different qualities, in mice of various strains and different weights. Because of its stability, a survival time of 3½ days is considered a manifestation of some intrinsic property of mice, and called a characteristic value of the response spectrum. If a dose which will produce death in 3½ days has been given, additional irradiation does not further reduce the life expectancy. A mouse can be made to die 3½ days after a small dose has been given if a supplementing treatment with a large dose is given within a certain time, which depends on the amount of the small dose. In order to produce the reaction which supersedes the 3½-day process after

large doses, it is necessary and sufficient to irradiate the head. In order to elicit the 3½-day process, it is necessary and sufficient to irradiate any large portion of the intestine. (auth)

1737

ATOMIC BOMB AND RADIOBIOLOGY. J. Jalet. J. radiol. électrol. 31, No. 7-8, 507-8(1950). (In French)

The author, a practicing radiologist, criticizes a paper by Génaud (Presse méd., 443(1949)) on the pathological effects of atomic bomb explosions which has put damages of the alimentary canal before those of the skin and the sexual glands in the order of gravity of lesions. This assertion is claimed to contradict all knowledge on radiolesions acquired from current radiological practice. It is true that conditions created by an explosion of an atomic bomb are very different from those existing during an x-ray treatment; however, the evidence supplied by Génaud is said not to exclude the possibility that the ulcerations of the digestive organs antedated the explosion.

1738

CASE OF POSSIBLE PREVENTION OF PERMANENT ALOPECIA FOLLOWING ROENTGEN THERAPY. Harry M. Robinson, Sr. Arch. Dermatol. Syphilol. 62, 702-3(1950) Nov.

A case is presented in which a patient received more than 800 r to each of four areas of the scalp. It is believed that, by prevention of the acute inflammatory reaction that usually follows such a dose by means of the continuous application of ice, the usual exudation, infection, and scarring were avoided. (auth)

1739

EFFECT OF ACUTE WHOLE-BODY X-IRRADIATION UPON WATER AND ELECTROLYTE BALANCE. Robert J. Soberman, Richard P. Keating, and Roy D. Maxwell. Am. J. Physiol. 164, 450-6(1951) Feb. 1.

Simultaneous repeated measurements of total body water, extracellular space, sodium space, whole blood, red cell, and plasma volumes, and plasma electrolytes were carried out in adult female dogs following 450- to 500-r whole-body x irradiation. Except for an increase in plasma volume and a decrease in red-cell volume, no consistent changes were noted in any of the determinations. (auth)

1740

THE EFFECT OF OVER-ALL TIME OF EXPOSURE UPON SURVIVAL OF YOUNG CHICKS FOLLOWING ROENTGEN IRRADIATION. S. Phyllis Stearner and Emily J. B. Christian. J. Am. Roentgenol. Radium Therapy 65, 272-6 (1951) Feb.

Survival following exposure to fractionated roentgen-ray dosages indicates that over-all time is of greater importance than dosage rate in determining the lethality of a given dosage for newly hatched chicks. Survival is increased as the over-all time of exposure is increased, but not at a proportional rate.

1741

EFFECT OF PHYSICAL AND CHEMICAL FACTORS ON PHAGOCYTOSIS IN THE PRESENCE OF IRRADIATED HUMAN BLOOD AND PLASMA. Jirair N. Sarian. Am. J. Roentgenol. Radium Therapy 65, 465-71(1951) Mar.

Anticoagulation measures, particularly citration, handicap phagocytosis in the presence of both normal and irradiated blood and plasma. Normal blood and plasma irradiated with 50 and 100 r did not lose their increased phagocytosis-enhancing properties after storage at 0°C for 48 hr. Non-irradiated samples showed a slight increase in their phagocytic powers after storage. Heating for 15 min at 65°C did not destroy the opsonins and agglutinins brought out by small-dose roentgen irradiation of blood and plasma. Softer rays seem to be more potent in producing such thermostable substances. Diluting the roentgen-ray dose optimal for phagocytosis does not cause a proportional decrease in the phagocytic power. 32 references. (auth)

1742

THE EFFECT OF VARIATION IN DOSAGE RATE OF ROENTGEN RAYS ON SURVIVAL IN YOUNG BIRDS. S. Phyllis Stearner. Am. J. Roentgenol. Radium Therapy 65, 265-71(1951) Feb.

Survival following roentgen irradiation of young birds depends on total dose, dose rate at which the exposure is made, and age at time of exposure. Exposure of 2- to 3-day chicks to 1000 r at a rate of 15 r/min or more resulted in 75% mortality within 24 hr. Exposure to the same dose at 6 r/min resulted in only 1% mortality within 24 hr, and 46% between 5 and 10 days after irradiation. The mechanisms leading to the early deaths are not clearly understood. It is suggested that the biological effects of variation in dose rate indicates recovery is taking place during an exposure at the low rate so that the total effect of the dose is less than if it were given at a high rate.

1743

THE EFFECT OF X-IRRADIATION ON ERYTHROGENESIS, PLASMA, AND CELL VOLUMES. Jacob Furth, G. A. Andrews, R. H. Storey, and Leon Wish. Southern Med. J. 44, 85-92(1951) Feb.

The pathogenesis of postirradiation anemia appears to be as follows: (1) After massive irradiation, erythrogenesis ceases almost immediately and is not resumed until after 7 to 14 days (as indicated by histologic studies of the bone marrow and reticulocyte counts). (2) During this time there is a fall in total red-cell mass as indicated by direct isotopic determinations. This fall is due: (a) to death of normally aging red cells with cessation of new cell formation, (b) to loss of red cells caused by heightened capillary permeability and secondary damage, and (c) possibly to other factors hitherto not recognized. (3) Simultaneous changes in plasma volume mask the magnitude of drop in erythrocyte mass; and consequently red-cell counts, hematocrits, and hemoglobin values do not indicate the exact degree of post-irradiation anemia. (4) Experimentally, the heightened permeability of capillaries following irradiation is indicated by rapid disappearance of various substances introduced

into the circulation. (5) Phagocytic reticulo-endothelial function is not markedly altered by irradiation. (6) The hypothesis is advanced that continuous leakage of erythrocytes through damaged endothelium to tissue spaces and lymph channels is a major factor in the causation of post-irradiation shock and anemia. (auth)

1744

EFFECTS OF INTENSE MICROWAVE RADIATION ON LIVING ORGANISMS. John W. Clark. Proc. I.R.E. 38, 1028-32(1950) Sept.

A search for deleterious effects upon animals (rabbits and rats) exposed to intense microwave radiation was made, and definite damage to the eye and to the testicle was found. Ten centimeters proved to be the most dangerous wavelength. The effects observed could be accounted for by the elevated temperatures produced by absorption of microwaves in the organism. A theory is presented in which these temperatures are calculated; fair agreement with experiment is obtained. This work demonstrates the need for caution on the part of those who work with intense microwave sources, and for the establishment of standards for the protection of personnel exposed to such radiation. (auth)

1745

FAILURE OF PUPATION OF EPHESTIA LARVAE FOLLOWING EXPOSURE TO X-RAYS. Anna R. Whiting. Paper presented at the 47th Annual Meeting of the American Society of Zoologists, Cleveland, Ohio, Dec. 27-30, 1950.

An abstract of this paper appeared in Anat. Record 108, 609(1950) Nov. and is reproduced here in its entirety.

The Mediterranean flour moth, E. kühniella, belongs to the group of insects (homodynamic) in which a continuous succession of generations occurs so long as conditions are favorable. In the course of several experiments full-grown larvae were irradiated with doses ranging from 40,000 to 160,000 r. Following a short period of inactivity they moved about normally and were readily stung and fed upon by the parasitic wasp Habrobracon. Those not exposed to the parasite continued to crawl, and none pupated. All lived for at least a few days and some (41/177 or 23.16%) were still alive 30 to 40 days after exposure. Control larvae pupated 3 days after time of exposure of treated larvae. The behavior of the irradiated larvae resembles that of diapause larvae in forms (heterodynamic) which show a prolonged arrest of growth in this stage. Whether the x-ray-induced inhibition is due to an interference with secretory processes controlling pupation or to injury to cells of the larval imaginal disks vital to pupal formation is not known. Two irradiated in prepupal stage pupated but have failed to close.

1746

IRRADIATION DAMAGE OF THE INTESTINES FOLLOWING 1,000-KV. ROENTGEN THERAPY. EVALUATION OF TOLERANCE DOSE. Harold I. Amory and Irving B. Brick. Radiology 56, 49-57(1951) Jan.

A study of the effects of 1000-kv irradiation on the small and large intestine in a group of 20 patients is reported. As contrasted to previous similar reports, the present study is unique in that the patients were male, the disease for which they were being treated (testicular tumor with or without retroperitoneal lymph-node metastases) does not affect the intestine, and only external 1000-kv radiation was used. Damage of varying degree to the small and large intestine occurred in some patients receiving large doses of such radiation into the abdomen. Correlation of roentgenologic findings and autopsy results is presented. Though great individual variation is shown in a study of the cases, it is believed that the small and large intestine of the adult male can tolerate 4500 r of 1000-kv irradiation administered in 54 days without deleterious results. (auth)

1747

IRRADIATIONS BY ROENTGEN RAYS AND HEPARINEMIA AND LEUKERGY. Feliks Stański and Roman Kordecki. Med. Weterynaryjna 6, 453-5(1950) Aug. (In Polish)

Experiments were conducted on dogs divided into two groups. In the first group, the dogs were irradiated with roentgen rays in various doses, and leukergy and coagulation time were examined. In the second group, the experimental dogs received heparin intravenously in various doses, and leukergy and coagulation time were examined. The results of the experiments in the first group are listed. It appears that small doses of roentgen rays cause a slow prolongation of the coagulation time, and the leukergy phenomenon appears only when the coagulation time is considerably prolonged (5×). The results of irradiations by larger doses of roentgen rays over a period of one month are also listed. The marked prolongation of the coagulation time was accompanied by a marked positive leukergy reaction. Postmortem and histological findings are reported as follows: local depilation of skin on the irradiated area, parenchymatous (cloudy swelling) degeneration of the liver, small focal hemorrhages and perivascular small-round-cell infiltrations in the kidneys, and proliferation of the histiocytary cells, especially in the liver. The results of experiments with heparin injected intravenously (vena saphena externa) in an 8-mg dose are shown. The coagulation time increased slowly, and leukergy appeared after 2 hr, culminating in 8 hr, when the coagulation time dropped almost to normal. The results of the influence of a large dose of heparin (12 mg) on the coagulation time and leukergy are shown. The coagulation time was very prolonged, and leukergy appeared after 2 hr, reaching its highest peak after 3 hr. Postmortem and histological findings were negative. It may be concluded that roentgen rays, causing an increase of heparin in the blood, produce thus a positive leukergy reaction.

1748

THE SIGNIFICANCE OF THE ACTION OF RADIOACTIVE PHOSPHORUS ON HABROBRACON JUGLANDIS ASHMEAD. Albert Martin, Jr. Proc. Penn. Acad. Sci. 24, 60-4(1950).

A summary of results of the effects of radioactive phosphorus on Habrobracon juglandis wasps is presented. Wild-type stock 33 were used throughout the experiment and were subjected to β rays of radioactive $Na_2HP^{32}O_4$. Females were placed in exposure vials in contact with nonradioactive P salts while depositing eggs which became the control. They were then placed in exposure vials with the P^{32} salt on the basis that the β radiation penetrates up to 1 cm of matter and would completely penetrate the body of the wasp. Among the progeny of each exposed female, virgin or nonvirgin,

there were on the average 28% abnormal individuals as against 1 or 2% in control cultures. Abnormalities such as misshapen wings, different numbers of antennae, short legs, and small over-all body size are described and discussed.

1749

THE MORTALITY OF BACTERIOPHAGE CONTAINING ASSIMILATED RADIOACTIVE PHOSPHORUS. A. D. Hershey, M. D. Kamen, J. W. Kennedy, and H. Gest. J. Gen. Physiol. 34, 305-19(1951) Jan. 20.

Bacteriophage T4 containing assimilated P^{32} is inactivated at a rate proportional to the specific radioactivity of the constituent P. The β radiation from the P makes a negligible contribution to this effect. The inactivation is therefore a direct consequence of the nuclear reaction, which kills the phage with an efficiency of about $1/_{12}$. Several phages related to T4 behave similarly. When radioactive phage is grown from a seed of nonradioactive phage, all the phage progeny are subject to killing by radioactive decay. The phage is killed by β radiation from P^{32} with an efficiency of about $1/_{100}$ per ionization within the particle volume. Bacteriophage T4 and its relatives contain about 500,000 atoms of P per infective particle. Virtually all this P is adsorbed to bacteria with the specificity characteristic of the infective particles, and none of it can be removed from the particles by the enzyme desoxyribonuclease. The P content per particle, together with the published data on analytical composition indicates a particle diameter close to 110 mμ for the varieties of phage studied. (auth)

1750

STUDIES ON THE MUTATION OF STREPTOMYCES GRISEUS NO. 200 BY X-RAY IRRADIATION. Yoshiro Okami and Hamao Umezawa. J. Antibiotics (Japan) 3, Suppl. B, 7-9(1950) Sept.

S. griseus No. 200 which produced streptomycin abundantly in Waksman's medium was x irradiated at the rate of 300,000 r/hr (length of time not given). Five black-pigment-producing mutants and one albino-type mutant were obtained. These morphological mutants did not produce streptomycin. After x-ray treatment strains which produced more than 1000 μg/ml of streptomycin were found, but they were not physiological mutants because they were not stable in their streptomycin-producing ability. Both English and Japanese versions of this article are presented.

1751

STUDIES OF RADIUM IN HUMAN BONE. Frank E. Hoecker and Paul G. Roofe. Radiology 56, 89-98(1951) Jan.

Portions of several different bones from two cases of osteogenic sarcoma attributed to radioactive substances in the bones have been examined microscopically and autoradiographically. The radioactive substances (chiefly Ra and its disintegration products) are found to be concentrated in numerous microscopic localizations. The maximum density of Ra in these localizations appears to vary by a factor of only about 1.5 from one type of bone to another, but the frequency of occurrence of these localizations may vary by a factor of nearly 25. Certain regions of some bones may be entirely devoid of Ra. The mineral residue of the sarcoma of one case contained only a negligible amount of Ra. This is believed to indicate that Ra was not mobilized from other portions of the body, although this apparently did occur in the case of Ca. This is interpreted as one line of evidence to indicate that Ra is not biochemically similar to Ca in all respects. (auth)

1752

UNUSUAL GLOMERULONEPHRITIS IN YOUNG CHILDREN, PROBABLY RADIATION NEPHRITIS. REPORT OF THREE CASES. Wolf W. Zuelzer, Harold D. Palmer, and William A. Newton, Jr. Am. J. Path. 26, 1019-40(1950) Nov.

Development of an unusual nephritis with fatal outcome following exposure to radiation in conventional therapeutic dosage is reported. The repetition of the same sequence of events in 3 cases made coincidence seem unlikely. The similarities in the age and the clinical course of the 3 patients, in the evidence of normal renal function and structure prior to radiation, in the comparable time interval between exposure and onset of renal failure, and in the identity of the pathologic changes in the kidneys point to a causal relation. Findings are presented in order to call attention to the possible dangers of conventional radiation therapy over the renal area of young patients and to stimulate further investigation which may support or disprove the hypothesis. 25 figures.

1753

VITAL STAINING WITH THE FLUOROCHROME ACRIDINE ORANGE AND ITS APPLICATION TO RADIOBIOLOGY. I. ALPHA-RAY EFFECTS. A. T. Krebs and Z. S. Gierlach. Am. J. Roentgenol. Radium Therapy 65, 93-8(1951) Jan.

The results of earlier preliminary investigations on the use of the acridine orange vital staining technique have been confirmed and extended. The findings are: (1) Cells and cell groups irradiated before staining and also irradiated stained cells demonstrate the radiation effect by a color change in the emitted fluorescent light as they become nonviable. When normal, the cells have a green fluorescence. When completely destroyed, the cells have a bright red fluorescence. (2) Intermediate stages or degrees of radiation damage are characterized by shades of yellow or orange fluorescence. (3) These changes occurring in cells under α radiation have been fixed on color film. (4) The amount of irradiation necessary to kill cells can be readily quantitated. By this means it is possible to study some of the details of radiation damage. The results reported together with the photomicrographs amply justify the use of the acridine orange vital staining method in radiobiology.

RADIATION HAZARDS AND PROTECTION

1754

Knolls Atomic Power Lab.
BIBLIOGRAPHY; RADIATION PROTECTION OF PERSONNEL AND RADIOCHEMICAL LABORATORIES; THEIR DESIGN AND OPERATION. Eunice Whittlesey and Eloise Givens. July 1950. 23p. (AECU-1020)

This bibliography has been compiled to fulfill requests for sources of information on special problems in the field of radiochemistry, radiation protection of personnel, and design and operation of radiochemical laboratories.

1755

A HANDS AND FEET CONTAMINATION MONITOR. F. S. Goulding and K. E. G. Perry. Atomics (London) 2, 43-50(1951) Feb.

The design of a permanently installed monitor for use in monitoring the hands, feet, and clothes of workers using radioactive materials is discussed. Provision for the detection of α, β, and γ contamination is included, and, as far as possible, the operation of the instrument is fully automatic to allow for use by unskilled workers. In the case of hands and feet, indication is given by meters showing intergrated counts over a short period, with an alarm bell to give warning of excess dose. A counting rate meter having a roughly logarithmic scale and also a loudspeaker indication are included for use with the clothing probes. (auth)

1756

MODERN RADIATION HAZARDS IN CLINICAL PRACTICE. W. V. Mayneord. Brit. J. Radiology 24, 6-11(1951) Jan.

The quantities of β- and γ-ray emitters now used clinically present hospital organizations with the same radiation problems arising in atomic energy projects. Clinical treatment techniques now frequently involve hundreds of millicuries of high-energy γ-ray emitters, and the new telecurie sources may well reach thousands of curies. Design of laboratories, importance of techniques, personnel dosimetry, waste disposal, and personnel exposure records are discussed.

1757

STACK DISPOSAL OF CHEMICAL WASTE. C. A. Gosline. Arch. Ind. Hyg. Occupational Med. 2, 621-30(1950) Dec.

An attempt has been made to show how dispersion characteristics of stack effuents vary. The degrees to which concentration varies with time are important. The stack effluents are not always present at a point even when the point is directly downwind from the source of contamination. Data are shown to demonstrate that stack disposal can be adequate in spite of the poor dispersion conditions that are known to occur. The characteristics of dispersion are discussed in light of the effects on phases of the problem, such as site selection, planning, legal aspects, and research in the medical field.

1758

THE USE OF PHOTOGRAPHIC FILMS FOR MONITORING STRAY X-RAYS AND GAMMA RAYS. R. B. Wilsey. Radiology 56, 229-41(1951) Feb.

Films used for monitoring stray radiation have previously been processed together with calibration films exposed to known quantities of radiation. Since the film response, in terms of roentgens, varies greatly over certain ranges of radiation quality, the calibrating radiation should, ideally, be of the same quality as the recorded stray radiation. In general, this is not practical. A suitable quality of primary radiation must be chosen which will enable the monitoring films to evaluate correctly, or at least not seriously undervalue, the incident stray radiation. The principal phases of this study have involved the comparison of the qualities of primary and attendant stray radiations and of their relative photographic and ionization effects, in order to select suitable calibrating radiations for various practical situations. Pardue, Goldstein, and Wollan (MDDC-1065) have proposed that Cd filters be mounted over the film to equalize its effective sensitivity over a wider range of radiation energies. The present experiments indicate the most favorable conditions for the use of this procedure for monitoring purposes. The application of the lead-cross packet in monitoring both the γ and β radiations from U is described briefly. (auth)

1759

X-RADIATION FROM ELECTRON MICROSCOPES. John H. L. Watson and Luther E. Preuss. Science 112, 407-9 (1950) Oct. 6. (Technical paper)

Results of a survey on x radiation produced while taking motion pictures of electron-microscope images are reported along with the data of surveys conducted on three instruments operating under normal conditions. Abnormal conditions which were in effect for motion-picture work were (1) the final viewing screen was tilted at an angle of about 30 deg, and (2) the usual 25-mil condenser aperture was opened to 50 mils. Thus, a more intense beam was allowed to strike an inclined target with a corresponding increase in x-ray hazard. Some remarkably high dosage rates were recorded for these circumstances. Maximum dosages as reported are maximum only for the conditions cited, namely, for variations in condenser current. Dangerous maximum dosages were recorded, but the conditions giving rise to them were usually transient in the microscope, and it is doubtful that personnel would receive daily doses above tolerance from them.

RADIATION SICKNESS

1760

EFFECT OF EARLY CROSS TRANSFUSION ON X-IRRADIATION DISEASE. Peter F. Salisbury, Paul E. Rekers, Joseph H. Miller, and Norman F. Marti. Science 113, 6-7(1951) Jan. 5. (Technical paper)

An examination of possible protective and regulatory factors of cross transfusion in the reduction of x-radiation toxicity is reported. A summary of some of the data obtained with the use of a cross-transfusion apparatus (Salisbury, Proc. Soc. Expti. Biol. Med. 71, 604(1949); Salisbury and Miller, ibid. 74, 16(1950)) is presented. Twenty-five adult mongrel dogs were used. The control group consisted of 19 dogs, and the treated group of 6. The latter underwent a single cross transfusion for approximately 2 hr within 4 hr after an irradiation of 450 r. A quantity of blood equal to the body weight of the recipient was exchanged between each pair of animals. Peripheral blood studies showed a depression of the total leukocytes to a mean value of 400 cells/mm^3 or less in the control group, whereas the cross-transfused group manifested a depression to only 1800 cells/mm^3 during a corresponding period after irradiation. The reticulocyte response in the control group was 0.2% or less in the entire postirradiation period, whereas the cross-transfused dogs showed a response between 1 and 2% by the 15th day after irradiation.

1761

PATHOGENESIS AND TREATMENT OF THE POSTIRRADIATION SYNDROME. J. Garrott Allen, Peter V. Moulder, and Daniel M. Enerson. J. Am. Med. Assoc. 145, 704-11(1951) Mar. 10.

The postirradiation syndrome is characterized by infection, hemorrhage, anemia, and malnutrition. Progress has been made in the treatment of these important disorders, and there is reason to anticipate even better results when several rational therapeutic programs are combined. Anemia can be controlled by blood transfusion, but this does not increase the platelet or leukocyte counts. Transfusion alone did not increase the survival period in dogs irradiated with 450 r, although it may appear more beneficial in less serious exposures. Transfusion every second day plus daily doses of aureomycin did increase the survival time, and 2 of 11 animals so treated have survived the critical period of 6 weeks. The general nutritive status of the person can be cared for orally for 1 to 2 weeks after exposure, but thereafter parenteral feeding may be necessary for several weeks. Frequent transfusions of blood and probably plasma are perhaps the best means to achieve this end. This is a new and serious problem which is largely foreign to previous experiences in burn therapy of nonirradiated persons, for whom extensive oral feedings are generally possible. Irradiation injury is a systemic disease. Wounds, burns, and other injuries must be considered in the light of the entire body economy, for the careful management of local wounds is of little consequence if the subsequent general physiological disorders are not taken into account. (auth)

RADIOGRAPHY

1762

Argonne National Lab.
PROGRESS REPORT; METHOD FOR EMBEDDING HARD MATERIALS, p.93-4 of **BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950.** James S. Arnold. [nd.] 2p. (ANL-4451(p.93-4))

Attempts are being made to develop a method for making detailed radioautographs of bone containing α- and β-emitting isotopes. Fixatives, embedding media, cutting and staining methods, and radioautographic techniques are being examined. Ca^{45}- and P^{32}-impregnated bones were fixed in 90% alcohol or formol in the monol form, and buffered with boraxo or with $MgCO_3$. Loss of either isotope in alcohol was small but as much as 10% was lost in formol. Buffering did little to preserve the isotope in bone. Celloidin embedding has been found to be quite unsatisfactory. Acetone, used instead of ether-alcohol as a solvent, improved penetration and provided more rapid and uniform drying and hardening. Several plasticizers were used in an effort to improve the adhesive and cohesive properties of the embedding medium. Preliminary studies indicated that diamylphthalate plasticized celloidin is a superior embedding material for the preparation of both thin and thick sections. Nuclear staining with safranine O and protoplasmic staining with azure were obtained using alkaline alcoholic solutions.

1763

LIQUID-EMULSION METHODS IN ELECTRON TRACK RADIOGRAPHY. D. T. King, J. E. Harris, and S. Tkaczyk. Nature 167, 273(1951) Feb. 17. (Letter to the editor)

A method for incorporating Paramecium caudatum, made radioactive by uptake of P^{32}, into a photographic emulsion is reported. Following development of the emulsion, the tracks of electrons originating from each organism can be seen and counted. A frequency histogram of the number of electron tracks from 136 individual organisms is shown. Tracks at a single focal level in the plane of one organism are also shown.

1764

RADIO-ISOTOPES IN MEDICINE. Tikvah Alper. S. African Med. J. 24, 1043-9(1950) Dec. 16.

South African scientists are able to obtain useful quantities of such short-lived radioisotopes as Na^{24} by airplane transport. Some representative tracer and autoradiographic medical research projects using various radioisotopes are discussed.

1765

THE THEORY AND METHODS OF THE RADIOAUTOGRAPHIC LOCALIZATION OF RADIOELEMENTS IN TISSUES. J. Gross, R. Bogoroch, N. J. Nadler, and C. P. Leblond. Am. J. Roentgenol. Radium Therapy 65, 420-58(1951) Mar.

A theoretical study has been carried out to determine the conditions giving the most satisfactory radioautographic images. The results obtained are as follows: (1) The resolution of the image is best when the thicknesses of section and emulsion, and especially the space between the two, are reduced to a minimum. (2) The preparation should be underexposed to obtain densities as low as may be conveniently identified. (3) The emulsion used should contain a high concentration of small grains of fairly uniform size, and should have a low background fog. The technical details of the practical application of these principles using the available photographic materials have been described for the various methods currently in use, namely "contact," "mounting," and "coating" methods. The best preparations have been obtained by coating sections with dilute medium lantern slide emulsion. Exposure was at low temperature. A critical review of recent radioautographic work illustrates the results obtained with various methods of radioautography. It is emphasized that the technique includes the chemical characterization of the radioactive material in the sections, an indispensable step in the interpretation of the radioautographic image. 98 references.

1766

TRACK AUTORADIOGRAPHY WITH IRON-59 AND SULPHUR-35 WITH QUANTITATIVE EVALUATION. Dag Campbell. Nature 167, 274-5(1951) Feb. 17. (Letter to the editor)

The technique of track autoradiography is described and discussed with reference to contrast radiography. Results of experiments with S^{35} and Fe^{59} following intraperitoneal injection into rats which were then sacrificed after 2 to 100 hr are reported. Different organs were processed by the usual histological technique. A stained track autoradiogram obtained with S^{35} of nasal septum focused on the photographic emulsion and an unstained track autoradiogram of rat placent. obtained with Fe^{59} are shown.

RADIOTHERAPY

1767

DESCRIPTION OF AN Sr^{90} BETA-RAY APPLICATOR AND ITS USE ON THE EYE. H. L. Friedell, C. I. Thomas, and J. S. Krohmer. Am. J. Roentgenol. Radium Therapy 65, 232-44(1951) Feb.

Under certain conditions the short range of β particles in tissue is particularly useful in radiation therapy. This is true in the eye where it is important to protect deeper structures, such as the lens, from deleterious radiation effect. An Sr^{90} β-ray applicator is described and the special advantages of Sr^{90} as a source of β rays is presented. Surface and depth-dose measurements of the applicator have been made, the dosage being recorded in roentgen equivalents. The clinical uses of the Sr^{90} β-ray applicator have proved satisfactory and are comparable to the clinical experiences in which the radon β-ray source was used. Superficial tumors of the eyelids and conjunctiva, vernal conjunctivitis, anterior segment tuberculosis, vascularizations of the cornea, and corneal ulcers have been treated with the Sr^{90} applicator. (auth)

1768

THE DEVELOPMENT OF A RADIOACTIVE ISOTOPE PROGRAM IN A GENERAL HOSPITAL. PART I. REQUIREMENTS FOR THE DEVELOPMENT OF A RADIOACTIVE ISOTOPE LABORATORY. PART II. CLINICAL APPLICATION OF RADIOACTIVE ISOTOPES WITH SPECIAL REFERENCE TO RADIOACTIVE IODINE (I^{131}) AND RADIOACTIVE PHOSPHORUS (P^{32}). L. J. Levinson, Edward Siegel, N. J. Furst, and David Tabowitz. J. Newark Beth Israel Hosp. 2, 28-40(1951) Jan.

General statements are made regarding the planning of a radioisotopes program in a hospital and regarding the useful isotopes with their availability and handling. Short note is made of the work of various investigators in radioisotopes therapy. 26 references.

1769

POLYCYTHEMIA TREATED BY RADIOACTIVE PHOSPHORUS. B. D. Vaughan. Med. J. Australia 2 (37th year), 623(1950) Oct. 21.

A case of polycythemia is described in which phenylhydrazine proved unreliable and P^{32} lost its effect after three administrations had caused temporary remissions and improvements of the blood picture.

1770

PRACTICAL ASPECTS OF THYROID DISEASE. George Crile, Jr. W. B. Saunders Company, Philadelphia, 1949. 355p.

The book is based on actual experience with 1000 patients operated on for thyroid disease and observations on several hundred patients treated with antithyroid drugs. The surgical, medical, and radiological aspects of thyroid disease are discussed. Sections dealing with antithyroid drugs, the use of radioactive iodine in the treatment of hyperthyroidism, and the employment of x rays in the management of subacute thyroiditis are included. A more complete review by J. W. Nadal may be found in Western J. Surg. Obstet. Gynecol. 59, 142(1951) Mar.

1771

PRACTICAL PHYSICAL ASPECTS IN THE USE OF RADIOACTIVE COBALT 60 AS A RADIUM SUBSTITUTE. Isadore Meschan, Raymond R. Edwards, and Paul J. Rosenbaum. Am. J. Roentgenol. Radium Therapy 65, 255-64(1951) Feb.

A discussion of the γ roentgen equivalency of Ra and Co^{60} is presented, and it is indicated that for practical purposes, with a thin filter for the Co^{60} such as 0.23-mm hyperchrome steel, the ratio is: Co : Ra = 1.3 : 0.84; K = 0.646. This ratio has been applied to Paterson-Parker charts for utilization of these established methods, and these new graphs are presented. (Paterson-Parker value × 0.646 = Co^{60} r equiv.) A cheap, stable, readily available method for encasing pure Co wire has been devised which utilizes hyperchrome steel tubing, 16 gauge, for the 1.0-mm wire. The wall thickness is more than twice that necessary for filtration of the weak β rays from Co^{60}, and yet is not sufficient to diminish the γ intensity. This tubing is readily made into needles, and is resistant to body tissue fluids. In rabbits there is no significant reaction to these hyperchrome tubes per se. These Co^{60} needles may be constructed at a fraction of the cost of "equivalent" radium needles. A method of standardization of Co needles against a National Bureau of Standards ampule of Co^{60} is presented. A sample calculation with corrected Paterson-Parker chart for use with Co^{60} is appended. (auth)

1772

RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL UNITS (LONDON 1950). Am. J. Roentgenol. Radium Therapy 65, 99-102(1951) Jan.

Recommended units, dose or specifications of conditions of roentgen and γ-ray treatments, and measuring instruments are presented, with the rules governing the selection and work of the Commission.

1773

SOME APPLICATIONS OF NUCLEAR PHYSICS TO MEDICINE. W. V. Mayneord. London, The British Institute of Radiology, 1950. 290p.

This supplement is a general review of the subject, highlighted with accounts in more detail of particular aspects

with which the author and his colleagues have been particularly concerned. The supplement is divided into two parts: Part 1 commences with a general account of the physics of the nucleus and nuclear reactions. Following the general physics is an account of the uses of five radioactive isotopes commonly employed in clinical techniques, P^{32}, I^{131}, Fe^{55}, Fe^{59}, and Na^{24}. In the diagnostic field, an account of many diverse uses is given. For completeness, the author has included in Part 1 a section on health hazards arising from the use of radioisotopes. Part 2 is concerned with isotope dosimetry, betatron and synchrotron measurements, and scintillation counting. A more complete abstract by W. A. Langmead appears in Brit. J. Applied Phys. 1, 334-5(1950) Dec.

1774

THORIUM X TREATMENT OF SKIN EPITHELIOMA, KERATOSES, AND DELAYED RADIATION CHANGES. J. J. Sher and William E. Howes. Radiology 56, 39-48 (1951) Jan.

Thorium X (Ra^{224}) in alcoholic solution or ointment, 150 to 300 μc/cc or g, applied directly to the part, is an efficient method of clearing senile keratoses, destroying superficial epitheliomas, as well as improving the cosmetic appearance following radiation damage to the skin and stimulating healing in the case of radionecrosis.

1775

TODAY'S PHYSICS AND MODERN MEDICINE. A. Sommerfeld, E. Rüchardt, and W. Rollwagen. Münch. med. Wochschr. 92, 1237-44(1950) Oct. 27. (In German)

A general, nontechnical review of the application of physics to medicine is presented. The electron and phase-contrast microscope, the possibility of an x-ray microscope, roentgen technique, ultrasound, trace elements, monomolecular layers, the biological action of ultraviolet, x-ray, neutron, and electron irradiation, and applications of tracers are briefly discussed.

1776

TREATMENT OF TUMORS OF THE THYROID WITH DIVIDED DOSES OF RADIOACTIVE IODINE. George Crile, Jr. Am. J. Roentgenol. Radium Therapy 65, 415-19(1951) Mar.

Multiple smaller doses of I^{131} appear to diminish the size of nodular goiters and to control hyperthyroidism more satisfactorily than single large doses. Since I^{131} is taken up irregularly by nodular goiters, most of a given dose, regardless of its size, may be concentrated in small, actively functioning areas. Large areas which are not functioning actively may receive little or no radiation from a single dose of I^{131}. After the most active areas are destroyed or inactivated by a small dose of I^{131} it appears that the less active areas can in turn be inactivated or destroyed by subsequent small doses. Papillary carcinomas of the thyroid tend to take up I^{131} in an irregular manner similar to nodular goiters, A case of papillary carcinoma of the thyroid in which the primary tumor and its cervical metastases have disappeared in response to multiple doses of I^{131} is reported. It is suggested that tumors of the thyroid which take up I^{131} in an irregular manner are more effectively and safely treated by divided doses of I^{131}, given at 6- to 8-week intervals, than by single massive doses. If a thyroid tumor does not take up I^{131}, the induction of myxedema may stimulate growth of the tumor. (auth)

TOXICOLOGY STUDIES

1777 ANL-4451(p.57-8)

Argonne National Lab.
PROJECTED RADIOTOXICITY EXPERIMENT, p.57-8 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. A. M. Brues, R. J. Hasterlik, Miriam P. Finkel, W. P. Norris, W. E. Kisieleski, and J. Schubert. [nd.] 2p. (ANL-4451(p.57-8))

Plans are reported for an intensive study of the chronic toxicities to small animals of Ra^{226} and some other heavy radioelements. The investigations will employ the same experimental and statistical methods that were used in previous experiments, including the long-term Po study now in progress. In addition, an attempt is being made to gain further information in cases of human Ra poisoning in this area.

1778

RATE OF ABSORPTION OF COBALT FROM THE PERITONEAL CAVITY AND RATE OF ELIMINATION FROM THE BLOOD. Nathaniel I. Berlin and William Siri. Am. J. Physiol. 164, 221-5(1951) Jan. 1.

An equation for the amount of a substance present in the blood at any time after an intraperitoneal injection of tracer quantities has been derived, provided certain assumptions are fulfilled. A graphical method of analysis of the curves of the blood level following an intraperitoneal injection has been presented. The rate constant of absorption of tracer quantities of Co^{60} from the peritoneal cavity and rate constant of removal from the blood when given as cobaltous sulfate and when complexed by histidine or cysteine have been determined. (auth)

1779

ROENTGENOGRAPHIC CHANGES AND URINARY FLUORIDE EXCRETION AMONG WORKMEN ENGAGED IN THE MANUFACTURE OF INORGANIC FLUORIDES. Edward J. Largent, Paul G. Bovard, and Francis F. Heyroth. Am. J. Roentgenol. Radium Therapy 65, 42-8(1951) Jan.

Samples of urine, obtained from employees of two factories in which inorganic fluorides are manufactured, contained fluoride in concentrations that ranged from normal levels of less than 1 mg/liter to abnormal levels as high as 28 mg/liter. Five workmen out of 16 who were examined roentgenologically showed increases in bony density. These men had excessively and consistently higher concentrations of fluoride in samples of their urine than did the employees whose bones were normal in density. Among the workmen whose bones showed increased opacity to roentgen rays, only two were found in whom the bone changes were marked. Neither of these workmen was demonstrably disabled.

TRACER APPLICATIONS

1780

Washington Univ., St. Louis School of Medicine
THE EFFECT OF SENSITIZATION AND X-RADIATION ON THE METABOLISM OF I^{131} LABELLED PROTEINS.
S. C. Bukantz, F. J. Dixon, and G. J. Dammin. [nd.] 10p. (AECU-1001)

The data reported support the view that I^{131} is a valid protein label in vivo. That is, after I^{131} protein injection, protein-bound I^{131} in the body fluids and tissues represents the originally labeled protein, while nonprotein-bound radioactivity indicates catabolism of the originally labeled protein. Characteristic curves of elimination of protein-bound activity from the blood are observed for each of the experimental groups described.

1781

Los Alamos Scientific Lab.
THE IDENTIFICATION AND RELATIVE DISTRIBUTION OF THE METABOLITES OF RADIOACTIVE NICOTINIC ACID AND NICOTINAMIDE. Edgar Leifer, Lloyd J. Roth, David S. Hogness, and Marion H. Corson. [nd.] 17p. (AECU-1045; LADC-901)

Six urinary metabolites were demonstrated following the injection of C^{14}-radioactive nicotinic acid or its amide using the technique of filter paper chromatography. Five of the compounds were identified as N^1-methylnicotinamide, nicotinuric acid, nicotinic acid, N^1-methyl-6-pyridone-3-carboxylamide, and nicotinamide. The sixth metabolite, corresponding to Band 4 of the chromatograms, is unknown but does not correspond to trigonelline. There was a quantitative, but not a qualitative, difference in the relative distribution of these compounds in the urines of the dog, rat, hamster, and mouse as a function of time after injection. All species produced $C^{14}O_2$ from carboxyl-labeled nicotinic acid and nicotinamide although CO_2 production by the various species differed quantitatively. 14 references. (auth)

1782

Brookhaven National Lab. and Johns Hopkins Hospital
PHOSPHATE TRANSPORT AND TURNOVER IN THE BRAIN.
Jacob Sacks and George G. Culbreth. [nd.] 11p. (AECU-1058)

A comparison has been made of the distribution of intracisternally and intravenously injected tracer P^{32}-phosphate between brain, blood plasma, and muscle in cats. In the course of 4 hr after the injection into the cisterna magna, about three-fifths of the tracer appears to be absorbed into the general circulation. Most of this absorption probably takes place during the first hour after the injection. There is a very rapid interchange of phosphate between the cerebrospinal fluid and the brain substance, with a high rate of incorporation of the tracer into the phosphocreatine and the labile P of the ATP (adenosine triphosphate) of the brain. The apparent turnover rate of the phosphocreatine and ATP of brain following the intravenous injection of the tracer is higher than the turnover rate of these compounds in resting muscle. The true turnover rate in brain is probably very much higher than the apparent rate. The experimental data support the view that the intravenously injected tracer becomes available to the brain substance for turnover by secretion into the cerebrospinal fluid. This process is apparently quite slow. (auth)

1783

Argonne National Lab.
PROGRESS REPORT; A COMPARATIVE STUDY OF THE TIME PATTERNS OF SR^{89} EXCRETION CHARACTERIZING VARIOUS LABORATORY ANIMALS; p.16-21 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. S. A. Tyler and Joan Gurian. [nd.] 6p. (ANL-4451(p.16-21))

Sr^{89} excretion data for the dog and goat are used to establish the excretion-time pattern for these laboratory animals. The following four empirical fitting processes are employed in determining this relationship: (1) the method of exponentials, (2) log-log regression analysis, (3) modified power fit, and (4) adjusted power fit.

1784

Argonne National Lab.
PROGRESS REPORT; RADIOBIOLOGY EXPERIMENT STATION, p.84-9 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. N. J. Scully, W. B. Chorney, A. A. Maass, C. W. Pettinga, R. Watanabe, and J. W. Glattfeld. [nd.] 6p. (ANL-4451 (p.84-9))

Opium poppy, tobacco, and alfalfa were grown in the nutriculture chamber in atmospheres enriched with C^{14}. Assay of opium poppy capsular tissue indicated an absolute activity of 185 $\mu c/g$ and a specific activity of 445 $\mu c/g$. Approximately 7.7 mg of morphine (specific activity 0.5 mc/g of C^{14}) has been obtained. Methods of extracting, isolating, and assaying C^{14}-containing plant compounds are being examined. Nicotine, simple sugars, and starch have been isolated in fair yield from tobacco, and it is expected that the results of these studies will provide better means of isolating C^{14}-containing compounds from tobacco and other species. Progress has been made in the extraction and isolation of sugars from Scenedesmus obliquus, and preliminary work has been initiated on the problem of biosynthesizing Co^{60}-labeled vitamin B_{12} in Streptomycin griseus.

1785

Oak Ridge National Lab.
THE INCORPORATION OF ISOTOPIC PHOSPHATE IN THE MONONUCLEOTIDES OF LIVER NUCLEIC ACIDS.
E. Volkin and C. E. Carter. Oct. 31, 1950. 11p. (ORNL-851)

Investigations have been carried out on the in vivo incorporation of P^{32}-isotopic phosphate into the component mononucleotides of liver ribonucleic aicd (RNA) and desoxyribonucleic acid (DNA). Mononucleotides were isolated by anion-exchange chromatography from hydrolysates of highly purified nucleic acids. This work reveals that a considerable variation in distribution of the isotope occurs among the nucleotides of DNA, thymidylic acid containing the highest activity. The distribution among the nucleotides in rabbit liver ribonucleic acid is essentially homogeneous, while rat liver and mouse liver ribonucleic acids exhibit a heterogeneous distribution of activity among the mononucleotides.

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These results, in conjunction with those of other workers, suggest that the evaluation of studies on nucleic acid turnover rates may be considered with regard to the metabolic turnover of the substituent components of nucleic acids, as well as to the nature of the isotopically labeled precursor. (auth)

1786

Radiation Lab., Univ. of California
A STUDY OF THE METABOLISM OF RADIOACTIVE CALCIUM (Ca^{45}) IN YOUNG, ADULT, AND RACHITIC RATS. D. M. Thomson and D. Harold Copp. Oct. 24, 1950. 4p. (UCRL-960(excerpt))

In the adult rats, the relatively slow uptake of radiocalcium by the skeleton reflects ion exchange with the Ca in the bone salt, since there is little or no new bone formation in these animals. Initial rapid uptake in the normal and rachitic young rats is associated with the metabolically active tissue in these animals. However, while the Ca becomes fixed in the skeleton of the normal animals, it is rapidly lost from the rachitic skeleton, suggesting that it is initially taken up in a very labile form. High urinary excretion and renal serum clearance in the rats with low phosphorus rickets, despite a normal level of blood Ca, indicates that there is a direct effect of rickets on the Ca clearance by the kidney. This may be associated with the low level of blood phosphate in these animals. In the adult rats, the renal serum clearance is almost the same as in young normals, and the urinary excretion is low, but fecal excretion is relatively high. The loss of radiocalcium from the body in these animals is not due to the kidney, but to fecal excretion. (auth)

1787

A CORRELATION BETWEEN THE SERUM PROTEIN-BOUND IODINE AND THE RADIOIODINE CONVERSION RATIO IN VARIOUS THYROID STATES. G. E. Sheline, M. C. Moore, A. Kappas, and D. E. Clark. J. Clin. Endocrinol. 11, 91-7(1951) Jan.

The conversion ratio of radioiodine, I^{131}, is correlated with the protein-bound iodine in the serum of individuals with various thyroid states. These determinations were found to be of approximately equal value in distinguishing between euthyroidism and hyperthyroidism. The conversion ratio did not distinguish four cases of hypothyroidism from the euthyroid group, whereas the serum protein-bound iodine did. The methods for determining the conversion ratio and the serum protein-bound iodine are discussed. (auth)

1788

LOCALIZED METAMORPHIC CHANGES IN THE SKIN OF RANA PIPIENS LARVAE BY SUBCUTANEOUS IMPLANTS OF MOUSE AND FROG THYROID GLANDS CONTAINING RADIOACTIVE IODINE. Jane Couffer Kaltenbach. Paper presented at the 47th Annual Meeting of the American Society of Zoologists, Cleveland, Ohio, Dec. 27-30, 1950.

An abstract of this paper appeared in Anat. Record 108, 526-7(1950) Nov. and is reproduced here in its entirety.

Local metamorphic responses, ascribed to the direct action of thyroid hormone, have been demonstrated in skin and other regions of amphibian larvae by implantation of thyroid glands and thyroxin-containing pellets (Hartwig, 1940; Kollros, 1942; Lüke, 1944; Kaltenbach, 1949). It is of interest to determine whether thyroid hormone in such cases is maintained in higher concentrations in regions of localized response than in the animal as a whole. I^{131} was injected subcutaneously into mice and frogs and was quickly incorporated into their thyroid glands. Two days later, fragments of the glands were implanted beneath the dorsolateral skin of young Rana pipiens larvae. General metamorphosis was accelerated, and metamorphic changes in skin overlying the implants were especially accelerated, as evidenced by localized thickening, stratification, cornification, molting, and glandular development. Radioautographs showed only slight local effects when I^{131} diffusion was rapid but marked effects when high concentrations were retained in the implants. At 1 day phagocytosis of the mouse implants was evident; I^{131} appeared in body fluids and was highly concentrated in the tadpoles' thyroid glands. Only slight changes occurred in the overlying skin. However, at 1 week some I^{131} remained in many mouse implants, and local skin changes were more advanced. In contrast, frog implants often became established. At 2 weeks I^{131} was highly concentrated in the follicles but not in the overlying skin, in which marked changes developed. The experiments demonstrate precocious induction of local metamorphic skin changes near subcutaneous thyroid implants containing relatively high concentrations of radioactive iodine.

1789

A METHOD FOR THE DETERMINATION OF TRACER PHOSPHATE IN BIOLOGICAL MATERIAL. L. Ernster, R. Zetterström, and O. Lindberg. Acta Chem. Scand. 4, No. 6, 942-7(1950).

A method allowing a quick and exact determination of the specific activity of orthophosphate present in a sample is described. This can be done even in the presence of creatine phosphate and radioactive pyrophosphate. After determination of the percentage of orthophosphate and of the specific activity of the orthophosphate, the amount of creatine phosphate and its specific activity may be determined in the same sample. In a homogenate the amount of orthophosphate and its specific activity can be determined in the same tube and at the same time as deproteinization is being carried out. (auth)

1790

RADIOACTIVE DIIODOFLUORESCEIN IN DIAGNOSIS AND LOCALIZATION OF CENTRAL NERVOUS SYSTEM TUMORS. Loyal Davis, John Martin, Moses Ashkenazy, George V. LeRoy, and Theodore Fields. J. Am. Med. Assoc. 144, 1424-32(1950) Dec. 23.

In 200 patients suspected of having central nervous system tumors and studied by means of radioactive I^{131}-diiodofluorescein, the results reveal a 95.5% accuracy in diagnosis in lesions verified by surgical intervention or corroborated by pneumography or angiography. The negative results also proved to be 95% accurate and were of equal importance in the differential diagnosis of cerebral neoplasms, especially from such lesions as hypertensive cerebrovascular accidents, perichiasmal arachnoiditis, meningovascular syphilis, and intracranial aneurysms.

1791

STUDIES OF RADIOGALLIUM AS A DIAGNOSTIC AGENT IN BONE TUMORS. W. C. Mulry and H. C. Dudley. J. Lab. Clin. Med. 37, 239-52(1951) Feb.

Geiger counting techniques applied to the skin surface of human beings have been shown to be useful for the localization of radiogallium (Ga^{72}) citrate in osteoid structures. Intravenous tracer doses of Ga^{72} citrate have been selectively concentrated in the osteoid lesions, both osteogenic and osteolytic, in 15 of 18 cases of primary and secondary bone malignancies. Concentration of Ga^{72} in malignancies involving bone approaches 20 times that found in the adjacent bone. Early metastases to bone have been identified through the use of tracer amounts of Ga^{72} before changes could be identified by x-ray film study. (auth)

1792

National Bureau of Standards
STUDIES ON THE ELECTROLYTIC REDUCTION OF NITRIC ACID. Walter J. Hamer. [nd.] 24p. (AECD-3027; A-493)

The current efficiency expressed as the hydrogen-ammonia ratio in the product formed at the cathode in the electrolysis of 3.59M HNO_3 was determined for 22 different electrode materials at a number of current densities. Also, 16 and 13 electrode materials were similarly studied in 0.669M and 0.114M HNO_3, respectively. Because of side reactions H_2 gas was never liberated in accordance with Faraday's law. Yields predicted by this law were approached for low concentrations at very low current densities, but were never attained. Effects of addition of ammonium nitrate and ammonium nitrite were investigated. Neither salt affected appreciably the current efficiencies. Higher current efficiencies. Higher current efficiencies were found for electrodes of Sb, Nb, W, and Ti than for electrodes of Pt. (auth)

1793

EXCHANGE OF ISOTOPES OF PHOSPHORUS IN THE SYSTEMS H_3PO_2-H_3PO_3 and KH_2PO_2-K_2HPO_3, AND TAUTOMERISM OF HYPOPHOSPHOROUS ACID. A. I. Brodskiĭ, D. N. Strazhesko, and L. L. Chervgatsova. Doklady Akad. Nauk S.S.S.R. 75, 823-5(1950) Dec. 21. (In Russian)

The absence of P isotope exchanges in systems containing phosphoric acid (or its ion), even after a prolonged heating (Ionin et al., Doklady Akad. Nauk S.S.S.R. 67, 463(1949); Lukovnikov et al., ibid. 70, 43(1950)), can be explained, as in other similar cases (Grinberg et al., ibid. 23, 918(1939)), by the coordinational stability of the P atom surrounded symmetrically by four O atoms in the PO_4^{-3} ion. Accordingly, it could be expected that in systems invoving H_3PO_2 and H_3PO_3, or the corresponding ions, isotope exchanges would take place. The experiment did not confirm this expectation. No exchanges were observed in the systems $KH_2P^*O_2$-K_2HPO_3 or $H_3P^*O_2$-H_3PO_3, either at room temperature or at 70°, as shown by the lack of appreciable radioactivity in $BaHPO_3$ precipitates obtained from the solutions after various time intervals. Negative results followed also experiments in which I or KI were added to the mixture of acids, although isotope exchanges do take place in analogous systems, such as $H_3As^*O_3$-H_3AsO_4 in the presence of I. This may throw some light on the question of the tautomerism of H_3PO_2, in analogy with what is known about H_3PO_3 since Arbusov's investigations (Zhur. Russ. Fiz. Khim. Obshchestva 38, 687(1906) 61, 1533(1929)). There may exist two forms of hypophosphorous acid, the "nonreactive" $OPH_2(OH)$ and the "reactive" $HP(OH)_2$. The oxidation by I, and the following isotope exchange, are preceded by a very slow transformation of the first form into the second, so that the velocity of the whole process is determined by this slow transition.

1794

Chemical Research Lab., Teddington
FUNDAMENTAL STUDIES ON THE PRECIPITATION OF URANIUM AND OTHER METALS FROM SOLUTION; PART V. THE HYDROLYSIS AND PRECIPITATION OF FERRIC IRON IN SULPHATE SOLUTIONS. T. V. Arden and Monica Jenkins. June 1950. 61p. (CRL-AE-61)

The hydrolysis of ferric iron in sulfate solution has been shown to take place in three stages, to form $FeOH^{++}$, $Fe(OH)_2^+$, and a precipitate which varies in composition according to the concentration. In solutions of about 0.0166M concentration, the precipitate is a basic sulfate resembling the mineral copiapite, $2Fe_2O_3 \cdot 5SO_3$. In more dilute solutions, less than 0.0033M, the precipitate consists of ferric pentoxysulfate, and at extreme dilution, when the pH approaches 7.0, it consists of a hydrated oxide. The hydrolysis constants for the formation of $FeOH^{++}$, $Fe(OH)_2^+$, and $Fe(OH)_3$ are $K_1 = 1.25 \times 10^{-3}$, $K_2 = 4.2 \times 10^{-4}$, and $K_3 = 95$. There is evidence for the existence in solution of an acid complex of the type $(HOFe)(HSO_4)_2$. On titration of ferric sulfate solutions at concentrations greater than 0.002M with NaOH solutions, three different stages of equilibrium occur, in various parts of the titration, over a period of several months. These stages are described.

1795

ON THE FORMATION OF COMPLEX COMPOUNDS BETWEEN CHLORIDES OF ALKALI AND ALKALI-EARTH METALS. E. P. Dergunov and A. G. Bergman. Doklady Akad. Nauk S.S.S.R. 75, 815-18(1950) Dec. 21. (In Russian)

In a work devoted to the study of the formation, through fusion of mixtures of metal halogenides, of "singular," or complex, chemical compounds identified by characteristic melting points (such as the formation of $CsCaCl_3$ in the system CsCl-$CaCl_2$), mention is made of singular compounds observed in the systems KF-ThF_4 and RbF-ThF_4 which have been previously described in Doklady Akad. Nauk S.S.S.R. 60, No. 3 (1948).

1796

THE PROBLEM OF SOLUBILITY OF COMPLEX SALTS. K. B. Yatsimirskiĭ. Zhur. Obshcheĭ Khim. 20, 2133-8(1950) Dec. (In Russian)

Using a theoretical approach that has led to the discovery of certain regularities in the solubility of simple ionic compounds (Kapustinskiĭ and Yatsimirskiĭ, Zhur. Fiz. Khim. 22, 1271(1948)), an analysis is made of fundamental factors that determine the solubility of complex salts, viz., dimensions of ions, their charges, and the presence of polar or hydrophilous groups in their compositions. Regularities are de-

duced permitting an explanation of differences in the solubility of certain groups of complex salts, and conditions are set forth under which difficultly soluble complexes can be obtained. It can be stated that in order to obtain a difficultly soluble compound of a given complex ion, or, more generally, of a given large ion (r > 2 A), another sufficiently large ion of opposite sign, and with a maximal possible charge, must be selected, the sizes of both standing in a certain optimal relation to each other; the given ion must not contain hydrophilous groups, while a well-expressed polarity within that ion is desirable.

1797

RUTHENIUM CHLORIDES. Martha A. Hill and F. E. Beamish. J. Am. Chem. Soc. 72, 4855-6(1950) Nov.

Ruthenium was completely converted to the trichloride by dry chlorination at 700°C. The trichloride sublimed to two different allotropic modifications with widely different properties. The shiny black form was the more inert, while the brown product was hygroscopic. Evidence for the presence of the di- or monochloride in incompletely chlorinated residues was inconclusive. (auth)

1798

STUDY OF BROMINE ISOTOPE EXCHANGES BETWEEN PROPYL BROMIDE AND SODIUM BROMIDE IN ALCOHOL SOLUTIONS. V. B. Miller, M. B. Neĭman, Yu. M. Shapovalov. Doklady Akad. Nauk S.S.S.R. 75, 419-22(1950) Nov. 21. (In Russian)

As part of a general study of the kinetics of isotope exchanges (Zaborenko et al., Doklady Akad. Nauk S.S.S.R. 64, 541(1949); Ionin et al., ibid. 67, 463(1949); Lukovnikov et al., ibid. 70, 43(1950); Neĭman et al., ibid. 71, 327(1950)), it has been shown previously that the activating energy of the exchange of iodine isotopes between I^- and KIO_3 (central position of I) is much higher than that of the exchange between I^- and C_2H_5I in alcohol solution (32,000 and 19,000 cal/mole, respectively). In the present work a similar reaction between $NaBr^{82}$ and C_3H_7Br in alcohol solution was investigated. The reaction was observed at various temperatures, the activity of the products being measured, for each temperature, at several consecutive time intervals. Equilibrium constants for each temperature were calculated, and the corresponding curve plotted; from the latter the activation energy was found to be 18,000 cal/mole. Presumably, the ionization $C_3H_7Br \rightleftharpoons C_3H_7^+ + Br^-$ precedes the isotope exchange.

CHEMISTRY

ANALYTICAL PROCEDURES

1799

Los Alamos Scientific Lab.
A FLUOROMETRIC METHOD FOR THE DETERMINATION OF URANIUM. Edward N. Wise. [nd.] Decl. Jan. 8, 1951. 17p. (AECD-3032; LADC-1023)

A method for the determination of μg quantities of U in concentrated H_2SO_4 solution in the range 0.1 to 25 μg/ml was developed, using the Farrand Photoelectric Fluorometer as the measuring instrument. The use of interference light filters permitted selective measurement of the intensity of one of several bands due to U, and also of the intensity of fluorescence which was present as a variable continuous background and which was presumed to be due to organic matter. The deflection of the galvanometer when measuring the U band minus the deflection when measuring the background was shown to be a linear function of the concentration of U in the sample. It was also shown to be necessary to cool all samples in a slush of dry ice and methanol before making fluorescence measurements. The method applies to U solutions that are free from fluorescence-quenching impurities. (auth)

1800

Argonne National Lab.
PRELIMINARY REPORT; SIMULTANEOUS DETERMINATION OF TOTAL CARBON AND CARBON^{14} IN SINGLE SAMPLES, p.59-62 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. D. L. Buchanan. [nd.] 4p. (ANL-4451(p.59-62))

A method has been developed for the simultaneous measurement of total C and C^{14} on single samples of either organic or inorganic material. The C is converted to CO_2 by wet oxidation, and other gases are removed by cold traps, solid reagents, and pumping. The purified CO_2 is measured manometrically and then transferred to a gas counter for the radioactive measurement.

1801

Chemical Research Lab., Teddington
THE ANALYSIS OF MIXTURES CONTAINING TANTALUM BY MEASUREMENT OF RADIOACTIVITY PRODUCED BY NEUTRON IRRADIATION. J. V. P. Long. May 1950. 8p. (CRL-AE-60)

A neutron-activation method is described for the determination of Ta in mixtures also containing Nb, Zr, Fe, Sn, Ti, and Si. The method depends on the pile irradiation of the sample followed after 4 days by measurement of the filtered γ-ray activity. An accuracy of approximately ±2% can be achieved. (auth)

1802

Chemical Research Lab., Teddington
THE DETERMINATION OF TOTAL TANTALUM AND NIOBIUM IN MINERALS AND ORES BY SOLVENT EXTRACTION IN THE PRESENCE OF ACTIVATED CELLULOSE. G. A. Wood. July 1950. 12p. (CRL-AE-62)

A chromatographic method is described for the separation of mixed Ta and Nb oxides from minerals and ores by extraction of the fluorides with methyl ethyl ketone containing

HF in the presence of activated cellulose. NH_4F is used to inhibit extraction of a number of other metals. After removal of the solvent, the Ta and Nb are precipitated with tannin and weighed as oxides. The ratio of the metals in the mixture may be determined either spectrographically or by neutron-irradiation analysis (CRL/AE-60). (auth)

1803

Atomic Energy Project (Canada)
ISOTOPIC ANALYSIS OF DEUTERIUM OXIDE BY DENSITY DETERMINATIONS. I. A. W. Morrison, B. Smith, and R. Walsh. Sept. 1949. 11p. (CRE-449)

The Hohwald balance, a pycnometric method, and the analytical balance with sinker attachment have an accuracy of ±0.1, ±0.2, and ±0.2% D_2O, respectively. The Hohwald balance and the analytical balance methods are faster than the pycnometric method. It is suggested that at least three density determinations should be made per heavy-water sample. The O^{18} and O^{17} concentrations in the deuterium oxide were found to be 0.659 and 0.0681%, respectively The density of heavy-water samples had to be corrected by a factor of 0.9995 in order to have the isotopic analysis as determined by density agree with the mass spectrometer analysis. The Mohr-Westphal balance according to specifications should be accurate to four decimals. This accuracy seems difficult to obtain in practice. (auth)

1804

MANUAL OF ANALYTICAL METHODS FOR THE DETERMINATION OF URANIUM AND THORIUM IN THEIR ORES. New Brunswick Lab., Washington, U. S. Government Printing Office, 1950. 55p.

This manual is a compilation of nine chemical methods for the analysis of pitchblende, carnotite-bearing sandstone, shales, phosphate rock, and monazite sands. A more detailed discussion of the analytical chemistry involved in the individual procedures may be found in National Nuclear Energy Series, Div. VIII, Vol. 1, published for the U. S. Atomic Energy Commission by McGraw-Hill Book Company.

1805

A REVIEW OF RECENT ADVANCES IN X-RAY ANALYSIS. W. Lawrence Bragg and THE IMPACT OF RADIOACTIVITY ON INORGANIC CHEMISTRY. H. J. Emelius. Brooklyn, N. Y. Chemical Publishing Co., Inc., 1950. 99p.

Two sets of lectures are bound together. The first traces the development of analytical methods using x rays. The second discusses the chemistry, experimental study, and applications of radioactive substances.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1806

Knolls Atomic Power Lab.
AN APPROXIMATE CRYSTAL STRUCTURE FOR THE BETA PHASE OF URANIUM. Charles W. Tucker, Jr. July 7, 1950. Decl. Oct. 3, 1950. 38p. (AECD-2957; KAPL-388)

An approximate crystal structure for the β phase of metallic uranium (stable between 660 and 760°C) has been deduced from x-ray-diffraction measurements made on single crystals of the phase retained in an alloy containing 1.4 at. % chromium and rapidly cooled from approximately 720°C. The diffraction data and other measurements show that the unit cell of the β phase is tetragonal with $a_0 = b_0 = 10.52$ A, $c_0 = 5.57$ A, and contains 30 atoms. Approximate positions of the 30 atoms in the unit cell have been deduced. The structure of the β phase is a layer structure with the layers lying parallel to the a_0b_0 plane of the unit cell at ¼ c_0 and ¾ c_0. Approximately midway between the layers are atoms which are linked to the atoms in the adjacent layers but not to each other. The low symmetry and complexity of the structure accounts for the hard, brittle nature of the phase. The interrelations between the α, β, and γ phases of the metal are clear from the β phase crystal structure.

1807

Ames Lab.
THE STRUCTURE OF THORIUM DICARBIDE BY X-RAY AND NEUTRON DIFFRACTION; CONTRIBUTION NO. 111 Elton B. Hunt and R. E. Rundle. [nd.] Decl. Dec. 11, 1950. 20p. (AECD-3021)

X-ray powder diagrams show that ThC_2 is not tetragonal, as previously reported. Single crystals have been obtained, and the lattice has been established as C-centered monoclinic with $a_0 = 6.53$, $b_0 = 4.24$, and $c_0 = 6.56$ A, $\beta = 104$ deg, $Z = 4$. The space group is C2/c or Cc. Thorium positions, determined by x-ray diffraction, are the same in either group, and satisfactory carbon positions have been found in C2/c by neutron diffraction. The structure contains C_2 groups, but the C−C distance is about 1.5 A, so that acetylene ions are eliminated. The arrangement of thoriums about the C_2 group combines ethane-like, ethylene-like, and acetylene-like character, and considerable covalent character for the Th−C bonds is indicated. (auth)

1808

THE CRYSTAL STRUCTURE OF $LaSi_2$. F. Bertaut and P. Blum. Acta Cryst. 3, 319(1950) July. (Short communication; in French)

The communication is translated here in its entirety.

Zachariasen (Acta Cryst. 2, 94(1949)) showed that the silicides of uranium, neptunium, plutonium, and cerium are isomorphs of $ThSi_2$, the structure of which had been established by Brauer and Mitius (Z. anorg. Chem. 249, 325 (1942)). Since thorium and the rare earths, of which cerium is a representative, are isomorphic in their borides, it is assumed that the all the rare earths are isomorphic in their silicides. This has been verified with $LaSi_2$ which has the space group I4/amd with the following atomic positions: (0,0,0) (½, ½, ½) + 4 La in (0,0,0), (0, ½, ¼), 8 Si in (0,0,0 ± z), (0, ½, ¼ ± z), where z = 0.417 ± 0.01. The cell parameters are a = 4.37$_4$ A and c = 13.56$_8$ A. The calculated density d = 4.95 g/cm³.

1809

THERMAL EXPANSION OF CRYSTALS. PART IV. SILVER CHLORIDE, LITHIUM FLUORIDE, AND MAGNESIUM OXIDE. S. S. Sharma. Proc. Indian Acad. Sci. 32A, 268-74(1950) Oct.

By employing the interferometric method, the temperature variation of thermal expansion of AgCl, LiF, and MgO crystals has been studied up to 325, 380, and 710°C, respectively. The coefficient of expansion has been calculated for each crystal and has been correlated with temperature by an interpolation formula of the parabolic type. Grüneisen's constant has been calculated for AgCl above the room temperature and for LiF from −222 to 400°C and is found to vary markedly with temperature in both cases. (auth)

1810

THE UNIT CELL AND SPACE GROUP OF AMMONIUM METAVANADATE, NH_4VO_3. Joseph S. Lukesh. Acta Cryst. 3, 476-7(1950) Nov. (Short communication)

Crystals of ammonium metavanadate were grown from water solution by dissolving powdered material at about 80°C and allowing the solution to cool. Lattice-constant measurements and density are in good agreement with a composition of NH_4VO_3. The precipitated crystals are clear, pale yellow plates or needles. The morphological symmetry appears orthorhombic with no evidence of hemihedry. Rotation and Weissenberg patterns were taken about the needle axis and precession patterns about the normal to the needle axis. From these, the unit cell was found to be orthorhombic with the following unrefined lattice constants: $a_0 = 4.96$, $b_0 = 11.82$, $c_0 = 5.63$ A; a : b : c = 0.420 : 1 : 0.476. The only systematic absences are h0l with l odd and 0kl with k odd. Two orthorhombic space groups are possible: C_{2b}^{9}-Pbc or D_{2h}^{11}-Pbcm. The holohedral appearance of the crystals suggests that the latter is more probable. Assuming the density to be 2.326 g cm^{-3}, the number of formula weights per unit cell is calculated to be z = 3.97 ≈ 4. The fact that z is a whole number is adequate evidence that the material is NH_4VO_3. The structure is discussed tentatively.

DEUTERIUM AND DEUTERIUM COMPOUNDS

1811

Radiation Lab., Univ. of California
THE PREPARATION OF A LITHIUM DEUTERIDE CASTING AND SOME PROPERTIES OF LITHIUM DEUTERIDE. Raleigh L. McKisson. Nov. 8, 1950. 8p. (UCRL-992)

It is thought that the neutrons produced by proton bombardment of a lithium deuteride cyclotron target might be more nearly monoenergetic than those obtained from targets currently in use. Lithium deuteride and lithium hydride have been found to be castable, and a suitable specimen has been cast for use as a cyclotron target.

1812

ANOMALOUS MOBILITY OF D^+ AND OD^- IONS IN HEAVY WATER. A. Gierer. Z. Naturforsch. 5a, 581-9(1950) Nov. (In German)

Measurements were made of the temperature dependence of the conductivity of DCl, NaOD, and NaCl dissolved (1) in D_2O, and (2) in mixtures of H_2O and D_2O. In (1) the conductivities at infinite dilution were obtained through extrapolation, while in (2) the deviation from linearity, as a function of the concentration of H_2O in D_2O, was determined. The results were found to agree with a theory of an abnormally high mobility of H^+, OH^-, D^+, and OD^- ions, due to a special mechanism of motion of H^+ and D^+ across hydrogen bridges which form a characteristic feature in the anomalous structure of water (Gierer and Wirtz, Ann. Physik(6) 6, 257(1949); J. Chem. Phys. 17, 745(1949); Z. Naturforsch. 5a, 577(1950)).

FLUORINE AND FLUORINE COMPOUNDS

1813

Carbide and Carbon Chemicals Div., UCC, K-25
THE PREPARATION OF CARBONYL FLUORIDE. A. V. Faloon and W. B. Kenna. Dec. 28, 1950. 9p. (K-707)

Carbonyl fluoride was prepared as part of a series of fluorine compounds being studied by the molecular spectroscopy section of this laboratory. It was prepared by passing carbon monoxide into a reactor containing silver difluoride at a temperature of 408°K. The product was condensed in a fluorothene tube cooled to 138°K. Carbonyl fluoride has an observed gaseous molecular weight of 65.4, and a boiling point of 190°K. It is colorless in the gas or liquid states and is white in the solid state. (auth)

1814

ON SOME NEW ACTIVE FLUORINE COMPOUNDS. H. Bode. Angew. Chem. 62, 449(1950) Oct. 7. (In German)

A brief report is presented of a paper read and discussed at the July 1950 meeting of the Society of German Chemists on KF_2 and RbF_2 obtained by the reaction of F_2 with halogenides. The problem of the interpretation of these substances either as polyhalogenides or as compounds of polyvalent alkali metals is examined.

GRAPHITE

1815

ELECTRON DIFFRACTION IN GRAPHITE. Jean Hoerni. Helv. Phys. Acta 23, 587-622(1950) Dec. 10. (In French)

A good agreement was found between results of a measurement of electron diffraction in graphite by the method of Kossel and Möllenstedt (Ann. Physik 36, 113(1939)) and the requirements of the dynamic theory of diffraction. Experimental data on crystal thickness and crystal structure could thus be accounted for. A comparison of several varieties of graphite revealed new information on the arrangement of successive layers in the crystals.

1816

A NOTE ON THE RHOMBOHEDRAL MODIFICATION OF GRAPHITE. G. E. Bacon. Acta Cryst. 3, 320(1950) July. (Short communication)

Further information on the proportion of rhombohedral structure in graphite has been obtained from x-ray-diffraction powder photographs. Two varieties of well-crystallized graphite, one natural and the other artificial, were examined using cylindrical specimens prepared by grinding, sieving, and extrusion in the usual way. The in-

tegrated intensity of the $10\bar{1}\frac{1}{3}$ line varied between 17 and 22% of that of the $10\bar{1}1$ line. The artificial graphite occurred in the form of a soft, flaky block practically randomly oriented. A small, approximately cylindrical fragment was cut from this for direct mounting, without powdering, in the x-ray camera. The intensity of the $10\bar{1}\frac{1}{3}$ reflection was then only 4% of the $10\bar{1}1$. The fragment was lightly crushed and reassembled by extrusion through a capillary tube, giving an increase to 9%. Further specimens were made after light and heavy grinding in an agate mortar giving, respectively, values of 11 and 17%. In a massive natural graphite specimen an increase from 8 to 24% was obtained when the block was reduced to powder by sawing. Corresponding increases of intensity of the $10\bar{1}\frac{1}{3}$ line were observed through the series of specimens. Inspection of the photographs also showed a small but definite broadening of the hkl reflections on powdering. Cylindrical fragments cut respectively parallel to and across the grain of the soft, flaky block gave values of 4 and 5% for the $10\bar{1}\frac{1}{3}$ intensity relative to $10\bar{1}1$. Specimens cut parallel and perpendicular to the extrusion direction of an extruded block made from powdered natural graphite gave values of 12 and 14%, respectively, although the preferred orientation in this block was so high that the 0004 and 0006 reflections showed a fourfold increase of intensity in the parallel specimen. These results would seem to support the conclusion that the proportion of ABC structure in well-crystallized graphites as formed is only a few per cent, but that it may be considerably increased by powdering.

1817

X-RAY AND NEUTRON DIFFRACTION BY GRAPHITE LAYERS. G. E. Bacon. Nature 166, 794(1950) Nov. 4. (Letter to the editor)

The letter is reproduced here in its entirety.

Franklin (Nature 165, 71(1950)) has shown that an anomalous two-fold increase of the x-ray-diffraction intensity is observed for the two-dimensional 10 carbon band. She explains this by the fact that the L-electrons are not distributed spherically about the carbon nucleus but are concentrated about the centers of the C−C bonds. Further evidence in support of this explanation from x-ray and neutron-diffraction measurements is presented. X-ray powder photographs of a sample of artificial graphite show an enhancement of about 85% for the $10\bar{1}0$ line relative to $11\bar{2}0$, and about 80% for the $10\bar{1}1$ line relative to $11\bar{2}2$. Franklin's assertion that this enhancement is not due to a temperature factor, as inferred by Lipson and Stokes (Proc. Roy. Soc. (London) 181A, 101(1942)), is confirmed by quantitative comparison of intensities on photographs at 20 and 500°C. These show that the components of thermal vibration are a maximum along the c axis and fall off as cos α to a negligible value in the plane of the carbon layers, where α is the angle between the c axis and the normal to any hkil plane. The magnitude of the intensity changes found corresponds to a Debye temperature of about 530°K for vibrations along the c axis. From these temperature effects even the $11\bar{2}2$ line, of those mentioned above, would be affected by less than 5%. In the case of neutron diffraction, the scattering centers are the nuclei, and not the electrons, so that if Franklin's explanation is correct the neutron intensities should show no anomalies. With the experimental arrangements for powder diffraction employed hitherto, the pairs of lines $10\bar{1}0$, $10\bar{1}1$ and $11\bar{2}0$, $11\bar{2}2$ are imperfectly resolved, so comparison has been restricted to the ratios of theoretical and measured intensities of the two pairs. These are in agreement to an accuracy of 5%, showing that the anomalous x-ray results appear to be almost entirely due to the asymmetric electron distribution.

LABORATORIES AND EQUIPMENT

1818

Los Alamos Scientific Lab.
A HIGH-PRECISION SEMI-MICRO AUTOMATIC TITRATOR. Edward N. Wise. [nd.] 22p. (AECU-1100; LADC-886)

An automatic titrator has been designed and constructed which has been shown to be capable of assaying 3- to 4-mg samples of Fe with an average precision of 0.9 part per thousand. The samples of Fe are converted to the sulfate and are reduced to the +2 valence state with an excess of titanous sulfate before being transferred to the titrator. The titrator automatically adds either sulfatoceric acid or potassium permanganate from a motor-driven syringe, both continuously and incrementally, to determine accurately first the oxidant-titanous equivalence point and then the oxidant-Fe equivalence point. The number of revolutions of the syringe-drive gear train between the two equivalence points is indicated, from which the operator can calculate the quantity of Fe in the sample, based on previous standardization runs of samples of sodium oxalate. (auth)

1819

General Electric Co.
EQUIPMENT FOR RADIATION LABORATORIES. 1950. 37p. (NP-1892; 3322RL)

This catalog includes prices and descriptions of equipment available from General Electric Company.

RADIATION EFFECTS

1820

Argonne National Lab.
PROGRESS REPORT; EFFECT OF X RADIATION ON SOLUTIONS CONTAINING ORGANIC STABLE FREE RADICALS, p.92 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. J. H. Pomeroy. [nd.] 1p. (ANL-4451 (p.92))

This section of the report is reproduced here in its entirety.

The effect of x irradiation upon solutions containing stable free radicals is being investigated. For instance, after irradiation a dilute solution of diphenyl picryl hydrazyl (DPPH) in chloroform loses its characteristic purple color as a result of the loss of the absorption band at 525 mμ. It is believed that this decolorization of the solution is caused by the combination of the DPPH radical with the free radi-

cals formed from the solvent by the absorbed radiation. The possible use of such solutions or gels of stable free radicals as chemical radiation dosimeters is under study. The use of such systems to trap the reactive fragments formed should also be of use in studying the chemical effects of radiation.

1821

Argonne National Lab.
THE EFFECT OF X IRRADIATION ON SOME PHYSICO-CHEMICAL PROPERTIES OF PROTEINS (abstract), p.95-6 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. E. S. G. Barron, Veronica Bonzell, Betty Gasvoda, and Louise Seki. [nd.] 2p. (ANL-4451(p.95-6))

Irradiation of serum albumin with doses of x rays ranging from 10,000 to 60,000 r failed to show any measurable changes in sedimentation rate or in electrophoretic mobility. Since protein denaturation and precipitation on irradiation with 70,000 r had been previously observed the dose was increased to 100,000 r, and sedimentation rate, electrophoretic mobility, and viscosity were studied. Electrophoretic measurements did not indicate that x irradiation, 100,000 r, caused appreciable changes either in the surface area or in the mobility of the protein.

On measuring the sedimentation rate of albumin and globulin irradiated at pH 3.0, a second faster-moving component was observed in both proteins. Addition, previous to irradiation, of 6×10^{-3}M of cysteine prevented the formation of this second component. This second component may be made up of two protein molecules joined together by oxidation of their -SH groups: protein-S-S-protein. Cysteine would then prevent such oxidation.

Irradiation of the proteins at other pH values failed to produce the faster-moving component. Serum albumin irradiated at pH 3 showed a large increase in intrinsic viscosity, while globulin irradiated at the same pH value showed no change at all. When the proteins were irradiated at their isoelectric points, albumin showed no change in viscosity whereas the globulin viscosity increased by about 20%. On irradiation at pH 7, there was 30% increase in the viscosity of albumin, while the viscosity of globulin showed an appreciable decrease.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1822

California Univ.
THE VAPOR PHASE HYDROLYSIS OF THE TRICHLORIDES OF LANTHANUM, PRASEODYMIUM, SAMARIUM, AND AMERICIUM. Abraham Broido. [nd.] Decl. July 25, 1950. 44p. (AECD-3012; UCRL-666)

Equilibrium constants at various temperatures in the range 350 to 550°C have been determined for the vapor-phase hydrolysis of the trichlorides of La, Pr, Sm, and Am. The reactions were studied by a flow method in which mixtures of HCl and H_2O gases were passed over the solid. From the data obtained and an estimate of the ΔC_p of the hydrolysis reactions, values were calculated for the heats and entropies of the reactions. The entropy change in the four hydrolysis reactions was calculated to be $\Delta S_{298°K} = 36.7$ cal/deg/mole. The heats of reaction at 25°C obtained were: $\Delta H_{La°} = 28.5$ kcal/mole, $\Delta H_{Pr°} = 25.5$ kcal/mole, $\Delta H_{Sm°} = 21.9$ kcal/mole, and $\Delta H_{Am°} = 23.0$ kcal/mole. In addition, the heat of formation of $LaCl_3$, -254.9 kcal/mole, was obtained by determining the heat of solution of La metal in 1.5M HCl, and from this value and the ΔH^0 of the corresponding hydrolysis reaction, the heat of formation of LaOCl was found to be -240.1 kcal/mole. (auth)

SEPARATION PROCEDURES

1823

Radiation Lab., Univ. of California
PERFORMANCE OF LIQUID-LIQUID EXTRACTION EQUIPMENT. Barney Rubin and Hugh R. Lehman. Sept. 12, 1950. Decl. Dec. 12, 1950. 56p. (AECD-3030; UCRL-718(excerpt)(p.22-77))

A discussion is presented to show that equations formulated by Colburn (Ind. Eng. Chem. 33, 459(1941) and Trans. Am. Inst. Chem. Engrs. 35, 211(1939)), for gas absorption tower calculations are applicable to liquid extraction towers, provided suitable refinements are added to allow for the behavior of liquid-liquid systems. 29 references.

1824

EXCHANGE OF ISOTOPIC IONS IN CATION EXCHANGERS. Lennart W. Helm and Torbjörn Westermark. Acta Chem. Scand. 4, No. 6, 968-9(1950). (Short communication)

The possibility that isotopes of an element in an ion exchanger might not be in dynamic equilibrium has prompted a study of the exchange between Ag ions on Dowex 50 resin. Ag^{111} was used as tracer, and experiments at room temperature were carried out both as single-stage and as column operations. All experiments showed clearly that there is a rapid exchange between ions bound to the exchanger and their isotopic ions in the surrounding solution. As would be anticipated this exchange was exponential with a half-time of the order of 1 to 2 min under the conditions employed.

1825

INVESTIGATION IN THE FIELD OF COMPLEX FLUORIDES OF TANTALUM AND COLUMBIUM; trans. from Zhur. Priklad. Khim. 20, 385(1947). (In Russian). G. S. Savchenko and I. B. Tananaev. July 26, 1950. 6p. (NP-2191)

A procedure for the separation of niobium and tantalum has been developed based on dissolving a mixture of the oxides in hydrofluoric acid, formation of potassium double fluorides of both metals, and precipitation of the K_2TaF_7 at 2% excess of acid.

1826

THE SEPARATION OF PROTACTINIUM FROM TANTALUM BY ION EXCHANGE. Yang Jeng-Tsong. Compt. rend. 231, 1059-61(1950) Nov. 13. (In French)

A plastic column filled with the anion-exchange resin Amberlite IR-4B and an eluant of 6.5N HF, brought to a pH of ~3 with conc. NH_4OH, has been shown to separate more than 90% of the Pa free from Ta in a single operation. Ta^{182} and Pa^{233} tracers were used to follow the exchange. The Pa is eluted after the Ta.

1827

VAPOR-PHASE FLUORINATION OF THIOPHENE. FRACTIONATION OF THE GASEOUS MIXTURE. Jean Neudorffer. Compt. rend. 231, 1070-2(1950) Nov. 13. (In French)

The fractionation of the gaseous products obtained in the course of vapor-phase fluorination of thiophene, during which they were collected in liquid-air-cooled condensers, has shown that essentially sulfur hexafluoride and a series of saturated fluorocarbons (CF_4, C_2F_6, C_3F_8, C_4F_{10}) are formed. These results were obtained by evaporation of the constituents under low pressure at various temperatures which were determined with precision. Important quantities of SF_6 were removed from the mixture at −145°C, which seems to be in contradiction with values of the vapor pressure of this compound given in the literature. An attempt will be made to determine the cause of this anomaly.

SORPTION PHENOMENA

1828

PHASE CHANGES IN ADSORBED FILMS AT THE GAS/SOLID INTERFACE. S. J. Gregg. Research, Suppl., Surface Chemistry, 205-16(1949).

Films of gas adsorbed on solids can exist in a number of different states, resembling the gaseous, liquid-expanded, liquid-intermediate, and liquid-condensed states of films on water. These states undergo transformations into one another, the nature of which is elucidated by a study of the film compressibilities calculated from the adsorption isotherms; transformations of "diffuse first order" seem particularly common. By making certain assumptions, absolute values of the compressibilities have been calculated; they are of the same order as those for films on water. It is suggested that adsorption hysteresis arises in many, but not all, instances from a suspended phase transformation within the film. 37 references. (auth)

SYNTHESES

1829

THE SYNTHESIS OF SARCOSINE AND BETAINE WITH C^{14} IN THE METHYL GROUP. Emery M. Gal, Robert E. Spenger, and David M. Greenberg. J. Org. Chem. 15, 1261-3(1950) Nov.

The synthesis of C^{14}-methyl-labeled sarcosine and betaine hydrochloride is described. The methods employed, adapted to radioactive work, led to more satisfactory yields than other methods given in the literature. (auth)

TRACER APPLICATIONS

1830

STUDIES OF THE EXCHANGE REACTIONS OF SOLID OXIDES. I. THE EXCHANGE OF OXYGEN ISOTOPES BETWEEN GASEOUS OXYGEN AND CERTAIN METALLIC OXIDES. E. R. S. Winter. J. Chem. Soc., 1170(1950) Apr.

Preliminary experiments are reported on the exchange of O^{18} between gaseous O and γ-Al_2O_3, ThO_2, TiO_2, and ZnO. It is shown that the reaction consists of an initial rapid exchange, followed by a slow process. A more detailed study of the exchange with γ-Al_2O_3 shows that the rapid process follows first-order kinetics, is independent of the O_2 gas pressure over the range 35 to 600 mm, and has an activation energy of 37.3 ± 0.5 kcal.

TRANSURANIC ELEMENTS AND COMPOUNDS

1831

California Univ.
HEATS OF FORMATION OF SOME AQUEOUS IONS OF AMERICIUM. Harold Russell Lohr. [nd.] Decl. July 25, 1950. 51p. (AECD-3011; UCRL-686)

The heats of formation of Pr^{+3} (aq) and La^{+3} (aq) have been measured in 1.5M HCl at 25°C to be −165.9 ± 0.9 kcal/mole and −167.0 ± 0.7 kcal/mole, respectively. The heat of formation of Am^{+3} (aq) under the same conditions was found to be −161.3 ± 1.4 kcal/mole. The latter value made it possible to calculate the heat of formation of Am^{+4} (aq) as −112.2 kcal/mole. It was impossible at this time to determine the heats of formation of AmO_2^+ (aq) and AmO_2^{+2} (aq). (auth)

1832

ON THE EXISTENCE OF NEW α EMITTERS. B. Gysae. Z. Naturforsch. 5a, 530-3(1950) Oct. (In German)

An α-activity range curve was plotted for a preparation obtained through repeated alternate precipitation with HF in oxidizing and reducing media, followed by a precipitation with ammonia. (No indication is given by the author as to the nature of the original substance.) After eliminating U with the aid of an $(NH_4)_2CO_3$ solution, another curve was obtained showing the presence of 2.1-, 2.5-, and (probably) 3.0-cm ranges. Since the only elements of atomic numbers below 92 which are precipitated by HF, viz., Ca, the rare earths, and Th, have been eliminated, it followed that one or more naturally occurring transuranic elements were responsible for the foregoing activities. This conclusion was supported by the measurement of the absorption of the β activity in Al, as compared with that of the decay products of U. (auth)

TRITIUM AND TRITIUM COMPOUNDS

1833

Los Alamos Scientific Lab.
THE HALF-LIFE OF TRITIUM BY ABSOLUTE COUNTING. Wesley M. Jones. [nd.] 10p. (AECU-1055; LADC-931)

UNIVERSITY OF MICHIGAN LIBRARIES

The results of a measurement of the half-life of tritium (average 12.41 yr) by absolute counting are presented. The method consisted of the mass-spectrometric analysis of a hydrogen-tritium mixture enriched in tritium, the dilution of some of this material with hydrogen in a known way to a countable level of activity, and the counting of a portion of the diluted gas in a Geiger counter of known effective volume. (auth)

1834

TRITIUM IN NATURE. A. V. Grosse, W. M. Johnston, R. L. Wolfgang, and W. F. Libby. Science 113, 1-2(1951) Jan. 5.

A procedure used to measure the tritium in highly concentrated heavy water samples that have been produced from surface waters and should contain natural tritium at about one-millionfold higher concentration than the original water is reported. It has been observed that such samples are indeed radioactive to an extent corresponding to a natural abundance of tritium of about one atom in 10^{18} atoms of protium. All the measurements completed to date have been made on Norwegian waters, although measurements on waters from other localities are in progress. All D_2O samples were redistilled, combined at room temperature with pure, freshly dehydrated CaO to give $Ca(OD)_2$, which was completely converted with zinc dust, at red heat, into D_2 gas, in line with the equation $Ca(OD)_2 + Zn - CaZnO_2 + D_2$. In this reaction isotopic fractionation is practically excluded because of high temperature and complete conversion. All samples were analyzed on a mass spectrometer for both chemical and isotopic composition. All samples were "monitored" to pure D_2 content. Results to date are given in tabular form.

URANIUM AND URANIUM COMPOUNDS

1835

Imperial Chemical Industries, Ltd.
THE COMPLEX BETWEEN $U(SO_4)_2$ AND HF. EVIDENCE FOR ITS EXISTENCE AND INSTABILITY. (Dekyl Fluoride, Miscellaneous Note 39). G. O. Morris. June 23, 1944. Decl. Nov. 8, 1949. 7p. (BR-454A; BDDA-221; R/GC/986/39)

Evidence to show the existence of a water-soluble complex between $U(SO_4)_2$ and HF with a ratio of 1 mole $U(SO_4)_2$ to 2 moles HF is presented. The substitution of alkali metals for H of the HF indicates that the complex is an acid. The probable formula is $H_2(U(SO_4)_2)$. An outline of a decomposition mechanism is included.

ENGINEERING

1836

New York Operations Office
SOME TECHNIQUES AND EQUIPMENT FOR TRACE QUANTITY SAMPLING OF INDUSTRIAL AEROSOLS. W. B. Harris and H. D. LeVine. Nov. 29, 1950. 24p. (NYO-1534)

The use of filter paper collection of air samples is compared with other methods and the advantages of filtration are discussed where gravimetric or radiometric analysis is desired. The design and construction of two reliable light-weight air samplers is given. One of these is for the range to 0.03 m^3/min where the other will operate to 2.0 m^3/min. Filter paper characteristics, cascade impactor characteristics, and field techniques for microgram aerosol concentrations are discussed. (auth)

HEAT TRANSFER

1837

California Univ.
A BRIEF REVIEW OF THE LITERATURE ON BOILING HEAT TRANSFER. G. A. Hawkins. June 1950. 50p. (COO-23)

The discussion covers nucleate and film boiling, local boiling, variables, nucleate boiling heat transfer in nonflow systems, and nucleate boiling heat transfer in flow systems wherein the fluids flow through tubes and annular spaces. 222 references.

RADIOGRAPHY

1838

USE OF AUTORADIOGRAPHS TO DETECT DEFECTS IN RADIUM NEEDLES AND TUBES AND INEQUALITIES IN THE DISTRIBUTION OF THE RADIUM. John H. Freed, Eugene P. Pendergrass, and Henry Raufer. Radiology 56, 99-103(1951) Jan.

Autoradiography is an important and useful method of testing Ra preparations for defects and uniformity of packing. Certificates, as issued by the manufacturer or by the U. S. Bureau of Standards serve as a guarantee of the purity and quantity of Ra, but do not give the purchaser any assurance regarding the uniformity of packing, and in some cases do not necessarily indicate the strength of the individual sources. This additional information can be obtained through autoradiographs. A simple method of making autoradiographs of Ra sources is described with illustrations of poor and satisfactory Ra distribution in direct or cell-filled needles.

TRACER APPLICATIONS

1839

RADIOACTIVE ISOTOPES IN INDUSTRY. I. METALLURGY. Atomics (London) 2, 39-42(1951) Feb.

Applications of radioisotopes in particular industries that have been reported will be surveyed in a series of articles of which this is the first. The present discussion is concerned with diffusion and self-diffusion of radioactive iron, properties of alloys, corrosion effects, metal cleaning, friction studies, electroplating, and factory-scale investigations.

VACUUM SYSTEMS

1840

AN IONIZATION PUMP. Robert Champeix. Vide, Le 5, 912-13(1950) Nov. (In French)

A patent on "a pump for obtaining very low pressures by using ionization of gas molecules" was granted in France to the company La Radiotechnique (No. PV 532839, Apr. 11, 1947). If the gas in a container to be evacuated is ionized, the ions can be forced into regions with a higher pressure than that existing in the container. A variant of such a pump is described, in which the ionization is produced by an electric discharge between two grid electrodes, the ions passing through the grids into a fore pump; a thermionic cathode furnishes an electron flux compensating for the decrease of ionization concomitant with the evacuation. A similar description was given by the author in Compt. rend. 231, 40(1950).

1841

WORKING PRINCIPLES OF THE JET (DIFFUSION) HIGH-VACUUM PUMPS. Enrique Gaviola. Rev. union mat. Argentina 14, No. 5, 444-63(1950). (In Spanish)

An experimental study was made of the factors governing the work of vapor-jet diffusion pumps. In the old controversy of the schools of Gaede (Ann. Physik 46, 357(1915); Z. tech. Physik 4, 337(1923)) and Langmuir (Phys. Rev. 6, 48(1916)) on the respective roles of diffusion and condensation in the mechanism of the evacuating process, the author takes the side of the latter group. Certain generally accepted assumptions are found incorrect, such as that ascribing the value 100 to the maximal compression factor, and that of the independence of the evacuation velocity from the original pressure if the latter does not exceed a certain value.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1842

THE RETRACTOMETER, AN APPARATUS FOR THE STUDY OF FRITTING OF POWDERS AND SOLID-STATE REACTIONS. Stéphane Tacvorian and Maurice Lévecque. Compt. rend. 231, 772-4(1950) Oct. 16 (In French)

By using fritted alumina stems between the material being studied and the levers of the registering device, linear variations may be measured up to 1800°C. Results of investigations on the fritting of compressed kaolin and alumina powders, solid-state reactions of alumina on magnesia and nitrogen on chromium, and allotropy of zirconia are reported briefly.

METALS AND METALLURGY

1843

Knolls Atomic Power Lab.
ALLOTROPY OF BERYLLIUM. (Letter submitted to the Editor, Journal of Applied Physics). A. U. Seybolt, Joseph S. Lukesh, and D. W. White. [nd.] 2p. (AECU-1047)

Reference is made to previous work in which the existence of an allotropic form of Be coexisting at room temperature with the normal form is indicated. Arguments against the probability of this phenomenon taking place have been assembled.

1844

Sylvania Electric Products, Inc.
THE PLASTIC BEHAVIOR OF SILVER SINGLE CRYSTALS AT VARIOUS TEMPERATURES. F. D. Rosi. [nd.] 2p. (AECU-1085)

The report is reproduced here in its entirety.

The plastic properties of Ag single crystals (99.99+) have been investigated at room temperature (295°K) and the temperature of dry ice (205°K) for small amounts of extension (max. 2%). Determinations of critical resolved shear stress and coefficient of shear hardening were made, and both properties were found to increase with a decrease in temperature. Furthermore, these properties were consistent with the Schmid law of critical shear stress governing the initiation of the slip process. Values of the elastic modulus at 295°K showed a marked dependence on the crystallographic orientation. At both temperatures the stress-strain diagrams demonstrate a rather sharp advent of plastic flow, and an almost linear rate of strain hardening. In all cases, the hardening rate increases after definite values of shear stress and shear strain which are independent of orientation. An analysis has been made of the dependence of this inflection in the shear stress-shear [strain] curve on the temperature of testing. Short-time creep tests (max. 3 min) were made by interrupting the loading along different portions of the stress-strain curves. These tests have yielded some interesting data correlating the rate of creep with both the rate of strain hardening and the temperature of testing. In addition, an orientation dependence of these curves has been established. At present this work is being

extended to include investigations at 77 and 373°K. Similar studies are also being made on single crystals of Cu and Mg.

1845

Sylvania Electric Products, Inc.
MEASUREMENTS ON THE RATE OF SECONDARY RECRYSTALLIZATION IN HIGH PURITY SILVER. F. D. Rosi and B. H. Alexander. Aug. 7, 1950. 3p. (AECU-1086)

The report is reproduced here in its entirety.

This investigation is one of a series primarily designed to measure the rate of growth of secondary grains at various temperatures for a number of high-purity metals (Al, Ag, and Cu). It is hoped that this will lead to a better understanding of the underlying atomic processes governing this recrystallization reaction. In this first group of experiments, measurements have been made of the secondary transformation in high-purity silver (99.99+) in the form of cold-rolled sheets 0.02-in. thick. Annealing these sheets in the temperature range 433 to 533°C produced a primary recrystallized structure with a grain size of the order of 0.02 mm. On prolonged heating in this temperature range, secondary crystals appeared at various points ranging in size up to approximately 2 mm in diameter. Generally speaking, these crystals exhibited a preferential growth in the direction of rolling and showed corrugated boundaries demonstrating visibly that the growth is proceeding preferentially along grain boundaries in accordance with the principles of boundary migration. The results of the growth velocity measurements showed that the rate of growth, V, is invariant with time similar to the growth rate of primary grains in a uniformly deformed test piece. Furthermore, it was established that the temperature dependence of the average velocity of invisible grain growth (reciprocal of "induction period") as well as the time-independent velocity of visible grain growth may be given by the expression $V = V_0 e^{-Q/RT}$. Thus, the velocity of grain growth in secondary recrystallization corresponds with the growth rate of most processes in solids involving relative movements of atoms. Activation energies have been calculated describing the temperature dependence of both the visible and invisible growth processes. These values strongly suggest that the underlying atomic process of crystal growth is one of grain-boundary self-diffusion. These results further suggest that grain growth is taking place during the so-called induction period by the same processes governing the growth of visible grains, and that this early-stage growth is probably impeded by the small number of contact areas between the growing grain and its surrounding fine-grained structure. Some studies have been made of the orientation relationships between the deformed and recrystallized structures. It was found that the secondary grains exhibited an orientation similar to the deformation texture. This indicates that the nuclei responsible for secondary recrystallization are formed during the deformation process, and that the orientation dependence of the secondary crystals is responsible for their growth. Experiments are also being conducted to study the effect of grain size of the primary recrystallized structure on the growth velocity of secondary grains.

1846

Oak Ridge National Lab., Y-12 Area
INVESTIGATION OF FAILURE OF TYPE 347 STAINLESS STEEL TANK FOR LITHIUM. F. J. Lambert and Charles Coughlen. Nov. 8, 1950. 24p. (Y-694)

A small tank, fabricated from 6-in. 347 stainless-steel tubing, cracked severely at the longitudinal-seam weld during the course of fabrication and erection of equipment designed to handle the flow of molten Li. The cracking occurred prior to any exposure of the tank to Li. This report details the failure, the examination procedures instituted as a result of that failure, and the conclusions resulting from the examinations. 14 figures.

1847

THE DILATATION OF METALLIC OXIDES USED IN CERAMICS. M. Jean Day. Bull. soc. sci. Bretagne 24, 13-19(1949). (Volume published Sept. 10, 1950). (In French)

The coefficients of expansion at low temperatures of alumina, zirconia, beryllia, rutile, quartz, magnesia, and uranium oxide have been determined by dilatometric methods over the range −130 to +50°C. The uranium oxide samples consisted of mixtures of U_3O_8 and UO_3 resulting from fritting at various temperatures of calcined $UO_2(NO_3)_2$. Coefficients for these samples were also determined at 375°C. Transformations indicated by changes in the coefficients of expansion were observed and are discussed.

1848

ELECTRODEPOSITION OF COPPER POWDER FROM ACID SULFATE BATHS. D. W. Drumiler, R. W. Moulton, and G. L. Putnam. Ind. Eng. Chem. 42, 2099-2102(1950) Oct.

Copper powder was prepared by electrodeposition from $CuSO_4$-H_2SO_4 solutions. The limits of the operating variables studied were as follows: temperature, 26.3 to 50.3°C; current density, 34.7 to 83.5 amp/ft^2; Cu concentration, 6.7 to 38.4 g of Cu, as the sulfate, per liter; and H_2SO_4 concentration, 9.9 to 195 g/liter. Current yields decreased at the lower temperatures and at the lower $CuSO_4$ concentrations; increasing the temperature and $CuSO_4$ concentration above the optimum values resulted in deposition of the Cu as an adherent plate instead of powder. Under the conditions tested, the yield of Cu powder increased with increasing acid concentration. Flow rate of the product increased with increase in Cu concentration and reached a maximum at about 100 g of H_2SO_4 per liter, whereas the percentage of powder finer than 200 mesh increased with decrease in temperature, current density, and Cu concentration. Over the range investigated, apparent density of Cu powder increased with increase in current efficiency. (auth)

1849

Battelle Memorial Inst.
FINAL REPORT ON CLADDING OF MOLYBDENUM TO THE RAND CORPORATION. W. L. Bruckart, S. J. Whalen, R. I. Jaffee, and B. W. Gonser. Apr. 25, 1950. 102p. (NP-1861)

This report covers an evaluation of the processing and properties of three kinds of commercially available Mo clad with a variety of potentially useful cladding materials. In all cases, the composites produced were of the double-clad type, usually with cladding thicknesses of 15% per side, although some work was done with thinner clads. The Mo core materials were of three types: electric-bell sintered (Fansteel), wet-hydrogen sintered (Westinghouse), and arc cast (Climax). The cladding materials were chosen for their oxidation resistance at elevated temperature. They were: Ni, Inconel, 18-8 stainless steel, 25-20 stainless steel, 27-Cr ferritic steel, Hastelloy B, Stellite 21, and Pt-10Rh alloy. Cladding on Mo was done successfully with Pt-10Rh, Ni, Inconel, and 18-8 stainless steel (Type 302) with bond strengths decreasing in the order given. On the basis of qualitative tests, the bonding of Mo to the Pt alloy appeared to be best. Various rolling temperatures were also investigated. In general, the use of lower finishing temperatures resulted in higher strength. Creep tests at 1800°F were conducted on 15% double-clad Ni and 15% double-clad Inconel, both on cores of Westinghouse and Climax Mo. The lowest creep rates were found with Ni-clad Westinghouse Mo. Oxidation tests of unstressed, clad Mo at 1800°, 2000°; 2200°F showed Inconel to be the superior of the two claddings insofar as metal loss by scaling is concerned. Studies of welding methods for joining and edge protecting clad Mo were made. Joints, braze-welded with an argon-shielded tungsten are using Hastelloy B filler metal, showed tensile strengths of 50,000 to 64,000 psi. Of the several methods and filler metals studied, argon-arc braze-welding using Hastelloy B, was the best.

1850

PERIODICITY IN THE EFFECT OF ADMIXTURES ON MECHANICAL PROPERTIES OF METALS. B. B. Gulyaev. Doklady Akad. Nauk S.S.S.R. 75, 25-8(1950) Nov. 1. (In Russian) (See also NSA 5-1023)

As pointed out in a previous paper (Doklady Akad. Nauk S.S.S.R. 74, No. 6 (1950)), changes in mechanical properties, produced in Cu, Ag, and Au by an admixture of an element, are periodic functions of that element's atomic number. This regularity is shown here to exist also for the following metals: Mg, Zn, Cd, Al, Sn, Pb, Fe, Ni, Pd, and Pt.

MINERALS AND MINERALOGY

1851

RADIOACTIVITY OF ROCKS: AN IMPROVEMENT IN THE PHOTOGRAPHIC TECHNIQUE. I. H. Ford. Nature 167, 273-4(1951) Feb. 17. (Letter to the editor)

A method for elimination of the air gap between a thin rock section and a photographic emulsion, during exposure for detection of radioactivity, and for the establishment of an intimate physical relationship between developed tracks and their source is reported. Experiments utilizing thin sections of Cornish granite of standard 30-μ thickness coated with thin layers of Ilford C2 emulsion in gel form are described. Photomicrographs of a small mineral grain in a coated section of DeLank granite showing associated α tracks are included.

PHYSICS

1852

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF JUNE 1, 1950. R. K. Wakerling. Oct. 26, 1950. 13p. (UCRL-767)

Experiments on the acceleration of stripped C-atoms have yielded 20,000 C atoms per second through a slit 0.15 in. wide (about 1/10 the actual external beam). Production of Cl^{34} by C ion bombardment of Al appeared successful. Studies are reported of mesons produced in a liquid H target bombarded by the deflected 340-Mev proton beam from the 184-in. cyclotron. (See also UCRL-713)

1853

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF JUNE 15, 1950. Henry P. Kramer. Oct. 26, 1950. 10p. (UCRL-787)

Meson detection by decay in which the resolution of the counting circuit has been improved is reported. Dynamics of the human circulation have been studied by the use of radioactive tracers, and techniques are described making it possible to measure the volume of extracellular fluid in the body that varies independently of the intracellular fluid volume. A high-energy γ-ray line from π^- capture in hydrogen is also reported.

1854

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF SEPTEMBER 29, 1950. Henry P. Kramer. Oct. 18, 1950. 8p. (UCRL-945)

Production of a π^+ Meson Beam Using the Deflected Proton Beam of the 184-in. Cyclotron. A very uniform, fairly well collimated beam of about 5000 mesons per second with a mean energy of 53.5 Mev and an energy spread of about ±2.5 Mev was obtained by allowing the 340-Mev deflected proton beam from the 184-in. cyclotron to impinge on a polyethylene target to take advantage of the high production of mesons from hydrogen in the forward direction and by separating protons from mesons by means of the magnetic field of a pair spectrometer magnet. The arrangement of target and magnet pole pieces is shown. (See also UCRL-922.)

Path of Carbon in Photosynthesis. It has been found, by terminating photosynthesis after sufficiently short intervals of time, that the first stable product formed is carboxyl-labeled phosphoglyceric acid. (See also UCRL-923)

Eradication and Development of Electron-sensitive Emulsions. Development proceeded in four steps: (1) phases were placed in a cold bath at 5°C. (2) Plates were developed at 26°C for 1 hr. (3) Emulsions were washed in a cold stop bath. (4) The customary procedures for washing and fixing were followed. Advantages of the procedure are reduction in grain variation and reduction of grain size of background tracks.

1855

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 9, 1950. Henry P. Kramer. Nov. 17, 1950. 5p. (UCRL-1010)

Measurement of the Half-live of AcC′ (Po^{211}). This half-life was measured by taking advantage of the fact that At^{211} is more volatile at high temperatures than its K-capture daughter Po^{211}. The value 0.52 ± 0.02 sec is reported.

Cloud Chamber Pictures of the Meson Beam. A positive meson beam has been channeled out of the block house at the 184-in. cyclotron and allowed to pass through a cloud chamber. The geometry of this situation is indicated in a sketch. The 55-Mev positive mesons that entered the cloud chamber could be identified by noting their H_ρ on both sides of a ¼-in. Pb plate placed along the diameter of the chamber. In particular, these mesons can be easily distinguished from electrons of the same H_ρ because such electrons are close to the threshold for ionization whereas the corresponding mesons produce quite heavy tracks, and, whereas electrons radiate continuously and thus change the curvature of the tracks, mesons, instead, undergo many small-angle Coulomb scatters.

Retarded Nuclear Forces and the Bound State. "Abstract for the December 1950 Meeting of the American Physical Society at UCLA." The following abstract is reproduced here in its entirety.

The description of a bound state is formulated in interaction representation using plane-wave normal modes. For this, an invariant counting technique is devised. Approximate forms of the "interaction Hamiltonian" and the resulting energy-momentum four-vector operators are obtained from a particular coupling model by application of perturbation theory and the correspondence limit. The "Schroedinger equation" takes the form of an eigenvalue equation, $P\mu\,\psi = p\mu\,\psi$ where $P\mu$ and $p\mu$ are respectively operator and eigenvalue, and ψ is the state functional. In order that the $P\mu$ commute, it proves necessary that the space-like surfaces over which ψ is defined be hyperplanes. This restriction does not destroy the covariance of the formalism, however. Solution of the Schroedinger equation may be effected by reducing from second to primary quantized form. This yields a set of integral equations with the energy and momentum of the compound system as eigenvalues. Equations for the deuteron will be presented.

1856

INFLUENCE OF THE NATURE OF THE SURFACE ON THE CONDENSATION OF MOLECULAR JETS OF ANTIMONY. Gustave Ribaud and Marcel Devienne. Compt. rend. 231, 740-2(1950) Oct.16. (In French) (See also NSA 4-4725)

The relative condensation of a molecular beam of antimony on various surfaces has been investigated by allowing a jet of radioantimony, $Sb^{122,124}$, from an orifice to fall on copper, aluminum, and glass plaques at about 70°C, and measuring the resultant β-emitting deposit with a Geiger counter and with an autoradiographic technique. The results obtained by the two methods were practically identical. Less radioantimony was deposited on glass and aluminum than on copper by the following ratios, accurate to a few per cent: glass/copper = 0.52, aluminum/copper = 0.44. The relative condensation of the reflected jet was also measured, with the same results.

1857

MAGNETIC PROPERTIES OF METALS AT LOW TEMPERATURES. PART I. B. I. Verkin, B. G. Lazarev, and N. S. Rudenko. Zhur. Eksptl'. i Teoret. Fiz. 20, 995-1010(1950) Nov. (In Russian)

In a study of magnetic properties of monocrystals of Cd, Be, Mg, Sn, and In, it was established that their magnetic susceptibility at low temperatures is a periodic function of the strength of the magnetic field. This effect is observed at different temperatures in different metals, and is characterized by parameters depending on the crystal structure of each metal. (auth)

1858

MEASUREMENT OF VAPOR PRESSURE OF SOLUTIONS OF He^3 IN He^4. B. N. Eselson, B. G. Lazarev, and N. E. Alekseevskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 20, 1055-6(1950) Nov. (Letter to the editor; in Russian) (See also NSA 4-5711)

Using a technique described in Zhur. Eksptl'. i Teoret. Fiz. 20, 742(1950), the vapor pressure of solutions of He^3 in He^4 was measured, with the result that, at He^3 concentrations at least up to 2%, the behavior of the solution is close to ideal. It is held probable that Raoul's law is followed also at higher concentrations, contrary to views of other investigators who had ascribed special properties to these solutions (Fairbank et al., Phys. Rev. 74, 345(1948); Takonis et al., Physica 15, 733(1949)).

1859

NEGATIVE IONS IN A DISCHARGE IN VAPORS OF HALOGENIDES OF ALKALI AND ALKALI-EARTH METALS. V. M. Dukel'skiĭ, E. Ya. Zandberg, and N. I. Ionov. Zhur. Eksptl'. i Teoret. Fiz. 20, 877-86(1950) Oct. (In Russian)

Only a few negative atomic ions are known, viz., those of the halogens, H, O, C, and S. An attempt at lengthening this list was made by submitting to a mass-spectrometric analysis ions generated in an electric discharge in vapors of halogenides of alkali and alkaline-earth metals. As a result, the existence of negative ions Li^-, Na^-, K^-, Rb^-, and Cs^- was established, while no Mg^- and Ca^- were found in vapors of $MgCl_2$ and $CaCl_2$. Molecular negative ions of the types $MHal^-$ and $MHal_2^-$ were observed for alkali metals, as well as ions $MHal^-$, $MHal_2^-$, and $MHal_3^-$ for $CaCl_2$ and $MgCl_2$. Furthermore, negative atomic ions of Ag were found in a discharge in AgI vapors. (auth)

1860

A NEW EVALUATION OF h/e BY X-RAYS. J. A. Bearden, F. T. Johnson, and H. M. Watts. Phys. Rev. 81, 70-2(1951) Jan. 1.

In previous evaluations of h/e by x rays the correction for the work function of the cathode has been the principal source of error. New experiments have been performed with a technique which eliminates this error and proves conclusively that in the usual x-ray method a correction for the cathode work function must be made. It is also shown that the separation of the fine structure peaks from the cut off point of the high frequency limit is a function of the voltage applied to the x-ray tube. The value of h/e computed with the new velocity of light is $(1.37928 \pm 0.00004) \times 10^{-17}$ erg sec esu^{-1}. (auth)

1861

A NEW FORMULATION OF THE LEAST-SQUARES CALCULATION OF ATOMIC CONSTANTS. J. A. Bearden and H. M. Watts. Phys. Rev. 81, 160-1(1951) Jan. 1. (Letter to the editor)

The authors have published elsewhere (Phys. Rev. 81, 73(1951)) the results of a least-squares calculation of the atomic constants, using the base variables F (faraday), N (Avogadro's number), and h to express all of the observed quantities, and availing themselves of Cohen's (Phys. Rev. 81, 162(1951)) modification of the least-squares method destined for the treatment of nonindependent experimental data. The obvious possibility that some other set of base variables might provide a more direct approach is illustrated here in a least-squares adjustment of some recent measurements, with the results that in this case it is possible to express several fundamental constants in terms of N, h, and e, and that those constants' numerical values, calculated by the usual least-squares procedure, compare precisely with previous results which were obtained with the aid of the more complex method of Cohen.

1862

NONINDEPENDENT OBSERVATIONAL EQUATIONS IN THE THEORY OF LEAST SQUARES. E. Richard Cohen. Phys. Rev. 81, 162(1951) Jan. 1. (Letter to the editor)

In recent years very precise measurements have been performed which yield information on the values of the fundamental physical constants e, m, h, and N (Avogadro's number); however, they are not as direct determinations of functions of the foregoing constants as one is accustomed to in direct measurements of h/e or e/m, so that the errors in the numerical values of the functions obtained are not independent. It follows that the usual least-squares analysis to determine an unbiased set of "best values" of the atomic constants must be modified so that it properly takes into consideration the nonindependence of the data. A general way of treating such problems is outlined here.

1863

A RE-EVALUATION OF THE FUNDAMENTAL ATOMIC CONSTANTS. J. A. Bearden and H. M. Watts. Phys. Rev. 81, 73-81(1951) Jan. 1.

A completely new evaluation of the fundamental atomic constants by the method of least squares is presented. A number of new and highly precise experiments have been taken into account, including the measurement of the velocity of light by Bol and Hansen (Phys. Rev. 80, 298(1950)). The results of recent experiments had been combined by several writers to compute e/m, F (faraday), and α (fine structure constant). All of the published values, including those of certain older experiments have been corrected for the new value of c and combined in a least-squares calculation. The results are presented in a complete table of the fundamental constants and are compared with the experimental values in an isometric consistency chart. Six of the experimental results: F, N (Avogadro's number), mN, α, e/m, and h/e are found to show excellent agreement with the least-squares values. (auth)

1864

ON THE GRAVITATIONAL FIELD OF THE MAGNETIC MOMENT. I. Z. Fisher. Zhur. Eksptl'. i Teoret. Fiz. 20, 956-7(1950) Oct. (Letter to the editor; in Russian)

In connection with the known hypothesis of Blackett on the relationship between the mechanical and the magnetic moments of heavenly bodies, the problem of the gravitational field of the magnetic moment presents a certain interest. It can be shown that in the first approximation there exists an equivalence between gravitational fields of a rotating, noncharged, nonmagnetic mass and a point magnetic moment. On the other hand, a nonpoint magnetic dipole cannot possess a static gravitational field.

1865

ON THE THEORY OF LIQUID He^3. I. Pomeranchuk. Zhur. Eksptl'. i Teoret. Fiz. 20, 920-4(1950) Oct. (In Russian)

The temperature dependence of the specific heat, viscosity, and heat conductivity of He^3 is theoretically investigated. The influence of exchange effects, due to the nuclear spin of He^3, on the phase transition from the liquid into the solid state is studied, and it is found that the heat of fusion at low temperatures must be negative and equal to $-R \ln 2$. Theoretically, it should be possible to reach temperatures of the order of 10^{-6} to 10^{-7} degree through adiabatic solidification of liquid He^3. Certain peculiarities of the nuclear magnetic susceptibility are examined. (auth)

COSMIC RADIATION

1866

Brookhaven National Lab.
PENETRATING SHOWERS ASSOCIATED WITH AIR SHOWERS. (abstract) R. L. Cool and O. Piccioni. Dec. 12, 1950. 1p. (AECU-1095)

The report is reproduced here in its entirety.

In extensive air showers at mountain altitudes we have observed, as have several authors, a component exhibiting similar properties to the so-called N-component. Observing directly hodoscope photographs and using large lead screens, we confirm that the observed penetrating showers are not of electronic nature. Using 80 counters as a hodoscope to observe the electron density, we find: (1) The frequency of extensive penetrating showers with electron

density $>\Delta$ is proportional to $\Delta^{-0.5}$ over a density interval of more than a factor of 100. This shows that associated penetrating showers are not produced by two or more independent particles and that the N-density is proportional to the electron density. (2) The frequency of extensive penetrating showers changes less than 20% for $\Delta \geq 15$ m^{-2} in moving the electron density detector from 5 m to directly above the penetrating shower detector; while it increases rapidly for smaller densities. (3) The density of the supposed N-component, in a single shower, decreases between 14,000 and 5,000 ft, following closely the decrease in density of the electronic component. This suggest that the N-component might be generated by the high-energy photoelectronic component.

1867

Brookhaven National Lab.
GUIDE TO RUSSIAN SCIENTIFIC PERIODICAL LITERATURE. John Turkevich and Ludmila Turkevich. Oct. 1950. 33p. (BNL-84)

A translation is given of Calculation of Moments of the Distribution Function of Shower Particles, S. Z. Belen'kiĭ, Zhur. Eksptl'. i Teoret. Fiz. 19, 940-5(1949). An abstract of this, from the Russian, appeared in Nuclear Science Abstracts as abstract 4-710.

1868

DISINTEGRATION OF PARTICLES GENERATING ELECTRON-NUCLEAR SHOWERS. M. I. Podgoretskiĭ, A. L. Lubimov, M. N. Shcherbakova, and L. Kh. Eĭdus. Doklady Akad. Nauk S.S.S.R. 75, 15-17(1950) Nov. 1. (In Russian)

Several recent high-mountain experiments made by various workers in the Pamir pointed to the existence of unstable particles in the component generating electron-nuclear showers. The method consisted generally in comparing coincidence numbers counted at different altitudes, using dense filters to compensate for the altitude difference. It is pointed out that, although data so obtained can also be interpreted as due to a density transition effect, such an interpretation is not generally true, the criterion being the sign of the transition effect. This criterion is applied in an analysis of some of the setups used in the experiments, and the presence of disintegrating particles in the showers under consideration is established. These particles are hardly μ mesons; they are probably π mesons having different equilibrium intensities in air and in dense matter.

1869

ENERGY DEGENERATION OF COSMIC-RAY PRIMARIES. F. J. Milford and L. L. Foldy. Phys. Rev. 81, 13-19(1950) Jan. 1.

Under the assumptions that a meson-producing collision between two nucleons with relativistic energies is completely inelastic and that the collision cross section is independent of energy, one can calculate the energy degeneration of the primary cosmic rays (assumed to be nucleons) and the energy spectrum of high energy nucleons as a function of depth in the atmosphere for any primary spectrum. Analytic solutions are obtained for the energy spectrum at any depth for monoenergetic and power-law primary spectra. The effect of the geomagnetic cutoff on a primary power-law spectrum is also investigated. (auth)

1870

FLUCTUATIONS OF THE ELECTRON-PHOTON CASCADE; MOMENTS OF THE DISTRIBUTION. L. Jánossy and H. Messel. Proc. Phys. Soc. (London) 53A, 1101-15(1950).

The second moments of the electron-photon cascades are evaluated. It is found that the mean-square fluctuation at the cascade maximum is that expected for a Poisson distribution or less; before and after the maximum the fluctuation exceeds greatly that expected for a Poisson distribution. The correlation coefficient between electrons and photons is zero for small thicknesses or near the cascade maximum. For other regions the correlation coefficient is positive. Both mean-square fluctuation and correlation between electrons and photons can be understood qualitatively in terms of fluctuation of effective depth. (auth)

1871

INVESTIGATION OF THE DENSITY SPECTRUM OF ATMOSPHERIC SHOWERS OF COSMIC RAYS. L. Kh. Eĭdus, M. M. Alymova, and V. G. Videnskiĭ. Doklady Akad. Nauk S.S.S.R. 75, 669-72(1950) Dec. 11. (In Russian)

In Doklady Akad. Nauk S.S.S.R. 74, No. 3(1950) a setup has been described which, at distances D not exceeding 60 to 70 m between two pairs of counter groups, registered only the electron-photon component of the extensive showers; at greater distances particles belonging to the "nuclear cascade" were, presumably, responsible for the coincidences observed. This setup was used again in a systematic work, in Moscow, D varying between 2 and 400 m. The magnitude determined was the exponent κ in the spectrum formula $N(>\rho) = A/\rho^{\kappa}$, where N is the number of showers whose densities ρ exceed a given value, and A and κ are altitude-dependent parameters. While increasing slowly at distances D<70 m, κ increases rapidly beyond that distance up to D = 170 m, then remains unchanged until D = 400 m, thus confirming the assumption of two different mechanisms at work in the center and at the periphery of an extensive shower. The larger values of κ were found to coincide with those of the exponent in the energy-spectrum formula of the primary rays; this coincidence may not be accidental; it may reflect some feature of the peripheral mechanism.

1872

ON THE LATERAL SPREAD OF EXTENSIVE AIR SHOWERS. L. Jánossy. Proc. Phys. Soc. (London) 63A, 1009-15(1950) Sept. 1.

The lateral and angular spread of extensive showers is calculated in an approximation where ionization loss and incomplete screening are neglected. The atmosphere is taken to be homogeneous. It is shown that the spread at the cascade maximum is equal to the average spread, but the spread increases considerably throughout the shower; these results are in qualitative agreement with results given by Borsellino (Nuovo cimento 6, No. 6, (1949)). The quantitative discrepancy between the results of Borsellino and other authors is commented on. (auth)

1873

STATISTICAL EVALUATION OF EXPERIMENTS ON THE ABSORPTION OF SHOWER PARTICLES. M. I. Podgoretskiĭ. Zhur. Eksptl'. i Teoret. Fiz. 20, 959-60(1950) Oct. (Letter to the editor; in Russian)

Of a certain number of particles in a cosmic-ray shower that enter a absorbing filter, one part is absorbed, another traverses the filter, while a third may generate secondary showers within the filter. The question arises whether it is possible in an actual experiment to discriminate between the two possibilities, viz., that of a simple absorption and that of a generation of secondary particles compensated by a stronger absorption. It is shown that such a discrimination can be made by submitting the experimental findings to a special statistical treatment.

1874

PENETRATING AND SOFT RADIATIONS EMITTED DURING NUCLEAR COLLISIONS. S. A. Wouthuysen. Nederland. Tijdschr. Natuurk. 16, 171-6(1950) Aug. (In Dutch)

The problem of the origin of the soft component of showers generated by cosmic radiation in lead and in photoemulsions is discussed, with a special emphasis on observations made by Bradt et al. (Helv. Phys. Acta 23, 24(1950)) which point to photons, themselves perhaps originating from neutral mesons, as the source of the electrons in a many-prong star.

1875

POSITIVE EXCESS AND EAST-WEST ASYMMETRY OF THE PENETRATING RADIATION BETWEEN SEA LEVEL AND 7300 m ALTITUDE. I. F. Quercia, B. Rispoli, and S. Sciuti. Nuovo cimento (9) 7, 715-47(1950) Sept. 25. (In Italian)

Results obtained from measurements of the positive excess at various altitudes and with the aid of magnetic lenses are found to agree with the single-meson production theory, provided an equal probability of the generation of charged mesons and of neutrettos is assumed. About 20% of the energy of an incident nucleon is ceded to the meson. A negative charge effect in the eastern direction is entirely accounted for by the influence of the terrestrial magnetic field on the meson trajectories. The set of experiments (45°50′ N geographical latitude, 60° zenithal angle) which revealed the latter effect showed also an E-W asymmetry in the primaries of about 12%. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1876

A SINGLE CRYSTAL X-RAY CAMERA FOR DIRECT RECORDING OF THE RECIPROCAL LATTICE. J. M. Torroja, E. Pajares, and J. L. Amorós. J. Sci. Instruments 28, 44-6(1951) Feb.

A camera is described for obtaining undistorted records of the reciprocal lattice by the method of De Jong and Bouman. The crystal is rotated about a zone axis which is normal to the plane of the photographic film, the film itself being rotated synchronously about an axis which is parallel to the axis of rotation of the crystal. The diffracted rays from the different reciprocal lattice planes emerge as a series of cones which are concentric about this axis. An annular slit in a screen placed between the crystal and the film restricts recording to one cone at a time. The opening angle of the cones, which would normally widen with the distance ζ of reciprocal lattice planes from the origin, is kept constant by varying the angle μ between the incident beam and the axis of rotation; the path lengths traversed by diffracted rays from different reciprocal lattice planes are thereby kept constant. (auth)

ELECTRICAL DISCHARGE

1877

AN EFFECT OF X RAYS ON GAS DISCHARGE AT VERY LOW PRESSURE. André Canac, Georges Maret, and Lazare Goldzahl. Compt. rend. 231, 1054-5(1950) Nov. 13. (In French)

A discharge tube containing either the occluded gas liberated in several hours or air admitted by a capillary leak, in both cases at a pressure of about 3×10^{-4} mm Hg, slightly below that necessary for a luminous discharge, passed a current of the order of 10^{-8} amp with 13,000 volts alternating current between the electrodes. Following irradiation of the tube between the electrodes by 60-kev, 8-ma tungsten-target x rays, the current instantaneously increased two- or threefold, then slowly diminished to the value preceding irradiation. When the x-ray beam was cut, the current through the sealed tube dropped instantaneously to zero, whereas no decrease was observed in the air-leak tube. A relation is suggested between these observations and the Joshi effect.

GASES

1878

TRANSPORT PROPERTIES OF DENSE MEDIA. I. THERMAL DIFFUSION IN ISOTOPIC MIXTURES OF GASES. W. L. Robb and H. G. Drickamer. J. Chem. Phys. 18, 1380-2(1950) Oct.

Based on Meixner's thermodynamics for irreversible processes (Z. physik. Chem. 53B, 235(1943)) and the work of Haase (Z. Physik 127, 1(1949)) an equation for the thermal diffusion ratio α, which can be evaluated from the equation of state, is presented. Using van der Waals' equation, α's are calculated in the critical region and compared with data for ethane-xenon. The equation reproduces all the essential features of the experimental results. Calculations made for a mixture of isotopes indicate that the effect of pressure on α cannot be attributed to selective clustering. (auth)

INSTRUMENTS

1879

Mound Lab.
ACID FUME SCRUBBER FOR STEAM VACUUM JET. R. L.

Bates. Nov. 20, 1950. Decl. Jan. 8, 1951. 2p. (AECD-3031; MLM-513)

An acid-transfer system was recently installed utilizing a steam vacuum jet followed by a water jet condenser. When it was placed in operation, considerable acid fumes were evolved at the condenser discharge causing the working area to be a health hazard. A stainless-steel duplicate of a standard laboratory filter pump was used to spray a weak caustic solution into the jet discharge. Fume elimination was complete during transfer of both organic and inorganic acids.

1880

Brookhaven National Lab.
CATHODE-FOLLOWER FALLACIES. Paul I. Richards. July 27, 1950. 3p. (AECU-988)

It is often stated in the literature that the low output impedance of a cathode follower offers the best solution to the problem of rapidly driving a large capacity or a low-impedance line. Although the cathode follower is indeed an excellent driver for a large capacity, the preceding statement is actually incorrect and hence somewhat misleading. The relative merits of the cathode follower and amplifier circuits are examined, and it is concluded that the cathode follower has only a slight advantage as regards input capacity, while the amplifier will generally give about twice as much signal voltage across a matched line and, for the same rise time, fully as much signal across a large capacity. Signal polarity will often be the determining consideration.

1881

Brookhaven National Lab.
MICROFORMER DILATOMETER. E. J. Vanderman. [nd.] 9p. (AECU-1096)

Since the test programs to be carried out by Brookhaven National Laboratory involved the determination of the coefficient of the expansion of radioactive specimens, it was necessary to devise a method by which the expansion measurements could be made at a safe distance from the test specimen. This was accomplished by modifying the quartz rod and tube type dilatometer so that the expansion measurements could be made with a variable differential transformer or "microformer," which consists of three coaxial coils spaced along an insulating coil form having an axial hole in which is suspended a small steel core. The two secondary coils are connected in series opposition so that, when the core is in a central position, the net output of the two secondary coils is approximately zero. Movement of the core in either direction from the central or zero point results in an output from the secondary coils.

1882

Brookhaven National Lab.
MECHANICAL STAGE ACCESSORY FOR COUNTING RECOIL TRACKS IN NUCLEAR EMULSIONS. Richard C. Roth. [nd.] 4p. (AECU-1098)

One of the techniques used in neutron monitoring involves the counting of proton recoil tracks in nuclear emulsions. The Health Physics Division of the Brookhaven National Laboratory employs a Bausch and Lomb Research Type microscope, Model DDE, with a 10X eyepiece and a 1.8-mm (98X) oil objective for counting these tracks in Eastman N. T. A. films. The maximum permissible dose has been expressed for this film as a certain maximum allowable number of tracks per field. Twenty-five fields of 0.15 mm each are routinely scanned. An accessory for the microscope which automatically and accurately moves the mechanical stage exactly one field 25 consecutive times is described. It may be adapted for any field size and for any predetermined number of fields and may be of use in other endeavors employing a microscope.

1883

Los Alamos Scientific Lab.
THE USE OF URANIUM AS A PUMP FOR HYDROGEN. R. C. Cornelius and S. E. Stephanou. July 7, 1950. 30p. (LA-1129; LADC-952)

The use of U as an absorbing medium for H_2 in a Zinn-type ion source was studied for the purpose of investigating the extent of recovery of H_2 and the resulting decrease in pressure in the accelerating tube attached to the ion source. With various geometries a maximum recovery of about 70% was obtained, and the accelerating tube pressures were decreased by a factor of two or more, depending on the flow rate of H_2 into the ion source. While the results obtained are only preliminary, this method may have applications under actual operating conditions of the ion source. (auth)

1884

Los Alamos Scientific Lab.
K-FACTOR FISSION CHAMBER. John H. Larkins. July 21, 1950. 8p. (LA-1136)

A fission chamber has been constructed to reduce excessive exposure of operators to radiation by reducing the complexity of operation and minimizing repairs and adjustments to the chamber during operation. Most of the reduction in exposure is due to the ease with which the chamber can be opened and the foil plates removed. The head of the locking rod is slotted for a large screwdriver and can be locked or released by turning it through 270 deg. A hinge-type snap-ring tool was made to remove the top space ring. This same tool also serves to remove the lower spacer ring and foil plates, all of which have similarly spaced holes drilled for that purpose.

1885

GAS INSULATION. A NEW TREND IN ROENTGEN-RAY APPARATUS. M. J. Gross. Am. J. Roentgenol. Radium Therapy 65, 103-8(1951) Jan.

Sulfur hexafluoride has properties which when properly utilized give advantages in small low-voltage roentgen-ray apparatus as well as in large high-voltage apparatus. For simplicity of design, it can be used at, or near, atmospheric pressure, and with some air contamination. 4 figures. (auth)

1886

PRECISE MEASUREMENT AND REGULATION OF MAGNETIC FIELDS WITH RADIO-FREQUENCY TECHNIQUES USING NUCLEAR RESONANCE. H. A. Thomas. Paper

presented at the 1951 Institute of Radio Engineers National Convention, New York, Mar. 19-22.
An abstract of this paper appeared in Prov. I.R.E. 39, 309 (1951) Mar. and is reproduced here in its entirety.

Protons in a water sample placed in a magnetic field H will absorb energy from a small r-f coil surrounding the sample if the coil is excited at the resonance frequency, $f_o = \gamma H/2\pi$ where γ is a known constant. This resonance phenomenon may be used to measure magnetic field strengths to an accuracy of 1 part in 40,000 and to regulate magnetic fields to within a few parts per million with relatively simple r-f apparatus. This paper includes a brief discussion of the phenomenon and the r-f techniques involved.

1887

USE OF A FREQUENCY-MODULATION DETECTOR TUBE AS A COINCIDENCE SELECTOR. Henri Piatier and Robert Génin. Compt. rend. 231, 1055-7(1950) Nov. 13. (In French)

The use as a coincidence selector of the Rimlock EQ-40 or Noval EQ-80 f-m detector tube described by Jonker and van Overbeek (Philips Tech. Rev. 11, 1-11(1949)) is proposed. This tube has seven grids G_1 to G_7. G_1 is a control grid similar in function to the first grid in an ordinary amplifier tube, G_2, G_4, and G_6 are screen grids, and G_7 is a suppresser grid. Grids G_3 and G_5 are identical negatively charged control grids to which are applied positive impulses from two radiation detectors such as G-M counters. The tube discharges only when both grids become positive simultaneously. A resolution time of 4×10^{-6} sec has been obtained using a 10^{-6}-sec transient source. Advantages are discussed, and suggestions for obtaining increased resolution speed are made.

1888

VELOCITY AND TWO-DIRECTIONAL FOCUSING OF CHARGED PARTICLES IN CROSSED ELECTRIC AND MAGNETIC FIELDS. I. Nils Svartholm. Arkiv Fysik 2, No. 3, 195-207(1950). (See also NSA 1-642)

A mathematical treatment using the path-equation method and limited to field combinations possessing cylindrical symmetry is presented. The equations of motion, directional and velocity focusing, geometrical aberrations for a point object, and directional focusing of the second order are considered.

MASS SPECTROGRAPHY

1889

MASS DEPENDENCE OF THE RELEASE OF ELECTRONS BY MEANS OF ISOTOPE IONS. Werner Ploch. Z. Naturforsch. 5a, 570-1(1950) Oct. (Note; in German)

The recently introduced method of measuring ion beams with the aid of electron multipliers (Leland, Phys. Rev. 77, 634(1950)) will require more detailed knowledge of the dependence of the phenomenon of electron release from metal surfaces on the mass of the bombarding isotope ion, the state of the surface, degassing, etc. Some preliminary tests are reported here. If g is the ratio between the intensities of released electrons and impinging ions, then for Li isotopes g_6/g_7 is between 1.1 and 1.2, with Cu, Mo, Pt, Be, Ni, and Cr-Ni as the bombarded metals and the accelerating potential varying between 200 and 7000 volts; the deviations are to be attributed to the surface characteristics. An analogous value for K isotopes is $g_{39}/g_{41} = 1.03 \pm 0.01$.

1890

MASS SPECTROMETER AS AN ANALYTICAL TOOL. Jens Geerk. Arch. tech. Messen, No. 179, 139-40(1950) Dec. (In German)

Generalities on the construction and the use of the mass spectrometer for analytical purposes are presented.

1891

Commissariat à l'Énergie Atomique
A MASS SPECTROMETER FOR THE RAPID ANALYSIS OF GASEOUS MIXTURES. C. Cassignol, Y. Ortel, and J. Taieb. 1950. 21p. (In French) (CEA-42)

A mass spectrometer for leak detection and rapid gas analysis were constructed, having the characteristics and several structural features of a simple instrument described by Siry in Rev. Sci. Instruments, 540(1947). Although exhibiting a good resolving power, the apparatus, which has no ion lenses and whose electrodes can be regulated during the performance, has not been sufficiently tested. Since several design defects have been discovered, it will probably be rebuilt with various improvements (ion source outside the magnetic field, modified circuits, etc.).

1892

THE MASS-SPECTROSCOPIC ANALYSIS OF ISOTOPES AND GASES; trans. from Zhur. Anal. Khim. 5, 58-72(1950). (In Russian) A. V. Trofimov. 1950. 30p. (NP-2241)

An abstract of the original paper, from the Russian, appeared in Nuclear Science Abstracts as NSA 4-3758.

MATHEMATICS

1893

ERGODIC THEOREM IN QUANTUM MECHANICS. Oscar Alberto Varsavsky. Rev. union mat. Argentina 14, No. 5, 350-65(1950). (In Spanish)

Methods of ergodic theory are applied to the phase space of quantum mechanics in the case of a finite number of degrees of freedom. A sequence of consecutive measurements is seen to behave as a Markov chain, which has a simple form if the a priori probabilities are assumed to be equal, and if the limit of their means agrees with the ergodic theorem. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

1894

Metallurgical Lab., Univ. of Chicago
NEUTRON MEASUREMENTS WITH CADMIUM COATED CHAMBERS. H. A. Wilson. Sept. 30, 1943. Decl. Dec. 27, 1950. 8p. (AECD-3023; CH-965)

Gamma-ray flux and energy absorption distribution due to ionization produced by slow neutrons in cadmium-coated spherical and cylindrical chambers, and in a cylindrical chamber with cadmium disk at one end only are calculated. The ionization produced by γ rays, slow neutrons, and fast neutrons in a cadmium-coated, hydrogen-containing chamber is discussed.

1895

Brookhaven National Lab.
SOME OBSERVATIONS ON CONTINUOUSLY SENSITIVE DIFFUSION CLOUD CHAMBERS. E. C. Fowler, W. B. Fowler, G. John, D. H. Miller, R. P. Shutt, and A. M. Thorndike. Oct. 2, 1950. 7p. (AECU-1069)

Recent studies of the operation of continuously sensitive diffusion cloud chambers (Langsdorf, Rev. Sci. Instruments 10, 91(1939)) seem to establish their usefulness for demonstrations as well as research tools. The arrangement and operation of such chambers is discussed. Experiments with different temperature gradients across a diffusion chamber are described. With a filling of air and methanol and a temperature gradient of 7°C/cm, cosmic ray tracks near minimum ionization are straight, sharp, and of good contrast. Photographs of cosmic rays and γ-ray-induced tracks are shown. No electric sweeping field is necessary when cosmic rays are observed, but radiations 5 to 10 times as strong will make the chamber temporarily insensitive to track production. Here an electric sweeping field greatly speeds up resensitization. The effects of different gases and vapors used in diffusion chambers have been investigated. The most important result is that with gases of low atomic number, such as He and H_2, a diffusion chamber will not behave stably at or near atmospheric pressure, but at higher pressures good results can be obtained. (auth)

1896

Brookhaven National Lab.
A THEORETICAL DISCUSSION OF DIFFUSION CLOUD CHAMBERS. (abstract) R. P. Shutt. Dec. 6, 1950. 1p. (AECU-1093)

The report is reproduced here in its entirety.

In his article on continuously sensitive cloud chambers, A. Langsdorf (Rev. Sci. Instruments 10, 91(1939)) proved theoretically that by letting vapor diffuse from a hot to a cold surface the supersaturation necessary for drop formation on ions can be obtained. In order to enable one to predict the "ideal" temperature distribution necessary to maintain the proper supersaturation through a given depth of a chamber, an attempt has been made to formulate theoretically the condensation phenomena not considered by Langsdorf. Drop growth and the motion of the drops through the chamber have been taken into account. Because the temperature of a growing drop adjusts itself almost instantaneously to its environment the problem can be treated as semistationary. By impressing the ideal temperature distribution for given conditions the most economical use of the available vapor could be made, and thus one might be enabled to obtain track formation through a greater depth in a chamber. Ideal temperature distributions for different conditions are to be discussed, and limiting gas pressures above which the operation of diffusion chambers may become impracticable will be given.

1897

Brookhaven National Lab.
OPERATION OF DIFFUSION CLOUD CHAMBERS AT HIGH PRESSURES. (abstract) D. H. Miller, E. C. Fowler, and R. P. Shutt. Dec. 6, 1950. 1p. (AECU-1094)

The report is reproduced here in its entirety.

High-pressure cloud chambers are well suited for the study of nuclear interactions in gases. Since high-pressure expansion chambers cannot be cycled frequently enough for efficient utilization of accelerators, a continuously sensitive chamber for pressures up to 20 atm has been constructed from a stainless-steel cylinder. Methanol vapor has been used almost exclusively so far. With air or argon at pressures above 3 atm it becomes increasingly difficult to provide sufficiently large temperature gradients to obtain formation through an acceptable depth of the chamber. With vapor diffusing downward in He or H_2 gases the chamber becomes stable only at pressures of several atmospheres, depending on the temperature distribution. For example, with H_2 at 15 atm, with an average temperature gradient of 6°C/cm, and with a bottom temperature of −60°C, the temperature of the evaporating liquid must be kept below 10°C. Under these conditions the track-sensitive layer is only 1.25 in. deep. A small amount of A (less than 0.5 atm) added to the H_2 stabilizes the chamber sufficiently to permit raising the liquid temperature to 30°C, increasing the depth of the sensitive layer to 2.5 in.

1898

Argonne National Lab.
DETERMINATION OF COINCIDENCE ERRORS IN GEIGER TUBES, p.90-1 of BIOLOGICAL AND MEDICAL DIVISIONS QUARTERLY REPORT FEBRUARY, MARCH, APRIL, 1950. R. Sato and W. P. Norris. [nd.] 2p. (ANL-4451(p.90-1))

This section of the report is reproduced here in its entirety.

Careful determinations of the counting rate of a standard radioactive sample of five closely similar mica end-window Geiger tubes over a period of several weeks have shown considerably more variation in count than expected. Inasmuch as the only variable that was not adequately controlled was the dead time of the Geiger tube itself, it seemed advisable to investigate resolution losses as a possible source of error. The method used was an extension of that used by Kohman (MDDC-905). The radioactive source was composed of eight individual sources. The individual sources (which were essentially free of coincidence error) were counted alone and then together in combinations to give various desired counting rates. The true count, represented by the sum of the individual counts, was compared to the count obtained by counting the samples together. The results indicate the dead time of the Geiger tubes to be in the order of 7 to 8 $\times 10^{-4}$ sec as compared with values of 2×10^{-4} sec which are ordinarily considered to obtain. Coincidence errors are therefore about 6% at a counting rate of 100 cts/sec rather than the 2% which would obtain with a resolving time of 2×10^{-4} sec. The importance of Geiger tube dead time to counting accuracy should be emphasized, especially since dead time may change slowly with time. A simplified method of determining dead time is being developed.

1899

Mineral Engineering Lab., Mass. Inst. of Tech.
A CIRCUIT FOR THE AUTOMATIC CONTROL OF COUNTING RATE METERS. James H. Pannell and Thomas J. Morrison. Dec. 28, 1950. 11p. (MITG-259)

A relay system has been developed for automatic scale selection on a counting-rate meter and for protection of the G-M tube from overvoltage. A list of parts for the control circuit is appended. (auth)

1900

Radiation Lab., Univ. of California
THE r-UNIT AT 320 AND 160 MEV. Edwin M. McMillan, Wade Blocker, and Robert W. Kenney. Nov. 10, 1950. 5p. (UCRL-1004)

The r unit is used today in at least two different ways: as a measure of radiation dosage and as a measure of x-ray intensity. The meaning of the former is fairly well defined in terms of energy absorbed per gram of tissue, and the standard thimble chambers are calibrated to read in these terms. The meaning of the latter is much less clear when considered in conjunction with high-energy x rays. Specifications for a standard setup to be used to define the r unit in terms of high-energy x rays, based on the use of a Victoreen thimble chamber inside a lead cylinder with ⅛-in. wall thickness, ⅝-in. ID, and 2-in. length are suggested. A method of calibration is desired.

1901

THE COUNTING EFFICIENCY OF COUNTER TUBES WITH ALUMINUM-, COPPER- AND GOLD CATHODES FOR X-RAYS IN THE RANGE 5 KEV TO 60 KEV; trans. from Helv. Phys. Acta 23, 381-411(1950). Hans Saurer; tr. by Alfred J. Moses. 1950. 51p. (NP-2221)

An abstract from the Russian of the original paper appeared as NSA 4-5279.

1902

A DELAYED COINCIDENCE SCINTILLATION SPECTROMETER. F. K. McGowan. Paper presented at the 1951 Institute of Radio Engineers National Convention, New York, Mar. 19-22.

An abstract of this paper appeared in Proc. I.R.E. 39, 309 (1951) Mar. and is reproduced here in its entirety.

A delayed coincidence scintillation spectrometer is an instrument which measures the lifetime of metastable states of nuclei in the time region 5×10^{-10} to 10^{-4} sec, the energy and type of radiation announcing the formation of the metastable state, and the energy of the radiation resulting from its decay. An instrument employing anthracene phosphor, 5819 photomultipliers, wide-band amplifiers, fast coincidence circuits, linear amplifiers, and differential pulse-height selectors is described in detail. Typical experimental results from an investigation of metastable states of nuclei decaying with mμ sec half lives are presented.

1903

EXPERIMENTS WITH A MAGNETIC LENS SPECTROMETER, EMPLOYING POST-FOCUSING ACCELERATION: THE L-AUGER LINES OF THORIUM-ACTIVE DEPOSIT. D. K. Butt. Proc. Phys. Soc. (London) 63A, 986-93(1950) Sept. 1.

A post-focusing electron accelerator has been developed to reduce the absorption of low-energy electrons by the Geiger-counter window of a β-ray lens spectrometer. Its useful range is for β rays having energies between 0 and 30 kev and although, in general, for a portion of this range only partial transmission will be obtained, correction curves for the absorption can be accurately determined. In order to test the spectrometer, an investigation of the L-Auger lines of thorium-active deposit has been made. An identification of the lines has been attempted. (auth)

1904

IONIZATION CHAMBERS AND COUNTERS. D. H. Wilkinson. New York, Cambridge Univ. Press, 1950. 266p.

The theory of counter and ionization pulse formation is discussed. Many aspects of initial and secondary ionization processes which lead to the observed pulse or current are analyzed and presented for practical cases. The sections on proportional counters and ionization chambers are particularly exhaustive and present much new information and interpretation. A more complete review by R. Beringer may be found in Science 113, 45(1951) Jan. 12.

1905

A LARGE β-SPECTROMETER WITH TWO-DIRECTIONAL FOCUSING FOR PRECISE MEASUREMENTS OF NUCLEAR RADIATION. A Hedgran, K. Siegbahn, and N. Svartholm. Proc. Phys. Soc. (London) 63A, 960-86(1950) Sept. 1.

In the present paper, a large double focusing spectrometer is described which is convenient for precise measurements of β and γ radiation. The magnetic field form is discussed and also the arrangement to measure the value of the field continuously with an accuracy appropriate to investigations of this kind. The difficulties due to electron straggling in the β source or converter are emphasized, and this effect is for the moment the factor which prevents the full utilization of the high resolving power of the apparatus. A number of typical spectra (Cs^{134}, Hg^{203}, Au^{198}, Zn^{65}, Fe^{59}, Co^{58}, and Ag^{110} photoelectron spectrum, Ag^{110} and Cs^{134} β spectrum, and Co^{60} and Br^{82} internal conversion lines) are given to illustrate the applicability of the instrument to different cases. 19 references (auth)

1906

A METHOD OF MEASURING GAMMA-RAY ABSORPTION COEFFICIENTS AT 0.51 MEV. P. E. Argyle, G. M. Griffiths, and J. B. Warren. Can. J. Phys. 29, 83-5(1951) Jan.

The coincidence method described makes use of the angular correlation between pairs of annihilation quanta to eliminate the effect of scattered radiation usually present in absorption measurements. Mass absorption coefficients in $(g/cm^2)^{-1}$ found by this method are as follows: lead, 0.1519 ± 0.0008; copper, 0.0819 ± 0.0005; and aluminum, 0.0831 ± 0.0013. (auth)

1907

National Research Council
PARTICLE AND QUANTUM DETECTORS. R. R. Wilson, D. R. Corson, and C. P. Baker. Jan. 1950. 40p. (NP-1889)

This report is a revision of an earlier review (Corson and Wilson, Rev. Sci. Instruments 19, 207(1948)) of the operating mechanisms and special properties of the particle and quantum detectors in most common use. The discussion is concerned with special features which make different detectors adaptable to different problems. The section on ionization chambers was revised to cover the use of gaseous, crystalline, and liquid media; the section on crystal counters is condensed because these counters have not fulfilled their early promise of usefulness. Sections are included on proportional and Geiger counter tubes. In view of the recent widespread application of scintillation counters, the section on electron multipliers and scintillation counters was expanded to include recent developments involving these detectors. In each of these instruments, the mechanism of detection was emphasized. 147 references.

1908

PHOTONS AND WAVES. D. Gabor. Nature 166, 724-7 (1950) Oct. 28.

Einstein's equation for the mean-square fluctuation of radiant energy in thermal equilibrium shows clearly two sources of noise: one arising from the indefiniteness connected with the concept of temperature, the other from the finite size of quanta. A third source arises in the interaction of radiation with matter from the finite size of the elementary electric charge. These three sources of noise or uncertainty set the limits by which we can empirically define concepts such as 'waves' or 'photons.' It is generally believed that these two methods of description become equivalent at very great quantum numbers. It is shown that though this is approximately true, the classical method is always slightly inferior to the quantum description as regards quantitative information content. Consideration is given to the practicality of quantum (photon) counters to take advantage of the slight increase in data carried by such a device.

1909

PHYSICAL MEASUREMENTS IN ROUTINE CLINICAL DIAGNOSIS WITH I^{131}. J. F. Tait, J. R. Cook, and R. Worsnop. Brit. J. Radiology 24, 14-16(1951) Jan.

It is stressed that in routine clinical diagnosis using I^{131} the drink should not be greater than 10 μc and that rapidity in carrying out measurements is important. Physical methods are described for meeting these more stringent requirements. Backscatter measurements are described which show that the backscatter factor in measuring thyroid uptake increases for Geiger-counter cathodes of higher atomic number. A double counter arrangement is described for reducing geometrical variations of thyroid position with only a single measurement. A more sensitive γ-ray counting method for urine samples has been devised. (auth)

1910

THE PRECISION MEASUREMENT OF HALF LIVES OF RADIOACTIVE SUBSTANCES. Lorna M. Silver. Can. J. Phys. 29, 59-65(1951) Jan.

A vibrating-reed electrometer with feedback amplifier has been used in conjunction with a differential ionization chamber to measure accurately the decay periods of several radioactive isotopes. This method proved to be simple, reliable, and free from uncertain corrections, with a low background due to the differential technique adopted and a low drift rate (normally less than 5×10^{-17} amp) due to the feedback electrometer circuit. This high and easily varied sensitivity enabled the decay to be followed over 12 periods, making possible the detection of, and correction for, any weak long-lived impurity activity thus eliminating one major source of error in half-life measurements. Least-squares analysis of the data showed that a quadratic mean error as small as ½% can be easily achieved with this apparatus. Half-life values were found as follows: Cu^{64}, 12.88 ± 0.03 hr; Cu^{66}, 4.34 ± 0.03 min; Ni^{65}, 2.564 ± 0.005 hr; Au^{198}, 2.69 ± 0.01 days; and In^{116}, 53.93 ± 0.03 min. (auth)

1911

A RADON MEASURING DEVICE. E. K. Darby and H. E. Johns. Am. J. Roentgenol. Radium Therapy 65, 472-5 (1951) Mar.

The authors have developed a radon-measuring device using standard electronic components which may be operated from an unregulated power line. The device is easily operated and at maximum sensitivity gives a full scale reading on a microammeter for a radon seed of 1.5-mc strength. The circuit, ionization chamber, calibration, and use of the instrument are described.

1912

SCALING CIRCUITS WITH NEON TUBES. L. N. Korablev. Doklady Akad. Nauk S.S.S.R. 75, 375-8(1950) Nov. 21. (In Russian)

Manley and Buckley (Electronics 23, 84(1950)) have recently described a scaling circuit involving the use of neon tubes; although employed in combination with germanium detectors, this instrument's performance does not exceed 500 pulse/sec. The present writer published descriptions of scaling circuits comprising neon tubes at an earlier date (Doklady Akad. Nauk S.S.S.R. 62, No. 2(1948); Author-right Certificates No. 87398 and 87417 (priority date July 10, 1948)). He gives here information on the principles underlying three of his circuits, whose performance is of the order of 5000 to 7000 pulse/sec.

1913

A SIMPLE RADIUM DETECTOR FOR USE ON RADIUM WARDS. J. Vennart. Brit. J. Radiology 24, 12-13(1951) Jan.

A neon-lamp Ra detector is described which will detect ½ mg of Ra at distances in excess of 8 in. The correct func-

tioning of the detector is checked by illuminating the detector lamp with the light from a second neon lamp in order to produce the same degree of ionization in the gas of the detector as is obtained when the Ra is in the detecting position.

1914

A SINGLE CHANNEL PULSE ANALYSER FOR NUCLEAR EXPERIMENTS. J. S. Eppstein. J. Sci. Instruments 28, 41-4(1951) Feb.

The instrument described was designed to measure the frequency–pulse size distribution from nuclear detectors. It accepts all pulses whose height falls between two voltage levels; the mean value of these levels is variable over a range of 5 to 40 volts, while the difference between them remains constant at one of two predetermined voltages. (auth)

MESONS

1915

Radiation Lab., Univ. of California
THE ANALYSIS OF π-MESON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS. Kenneth M. Watson and Keith A. Brueckner. Nov. 7, 1950. 63p. (UCRL-856(Revised))

A phenomenological analysis of meson production in nucleon-nucleon collisions is proposed. On the basis of an hypothesis that the production takes place for collisions whose impact parameters tend to be less than the range of nuclear forces, a partial wave analysis of the scattering matrix is given. The theory seems capable of describing the experimental results in a simple manner. It is shown, on the assumption that the π-meson is pseudoscalar, that angular momentum and parity considerations play an important role in interpreting the experimental results.

1916

DECAY OF SCALAR MESONS WITH EMISSION OF RADIATION. M. S. Gobedzhishvili. Zhur. Eksptl'. i Teoret. Fiz. 20, 893-7(1950) Oct. (In Russian)

The probability of a decay of a scalar meson resulting in the formation of an electron and a neutrino has been investigated by Bethe and Nordheim (Phys. Rev. 57, 998 (1940)). The case of a spontaneous disintegration of a scalar meson into an electron, a neutrino, and a photon is examined here. The elementary probability of such a decay is calculated, and it is shown that, for small photon energies, the total probability diverges logarithmically. (auth)

1917

MESON EFFECTS AND THE DEUTERON. M. Markov. Doklady Eksptl'. i Teoret. Fiz. 75, 655-8(1950) Dec. 11. (In Russian)

A capture of a meson by a deuteron must result, as in the case of the photoeffect, in a specific disintegration of the deuteron; as shown by Faĭnberg (J. Phys. U.S.S.R. 5, 177 (1941)) such an effect is very sensitive to the nature of the meson field (whether scalar, pseudoscalar, etc.); and it is found also that the spectrum of the generated nucleons is not monochromatic. As to reverse effects, they are assigned unexpectedly large cross sections; the cross section for the capture of a fast neutron by a proton, accompanied by an emission of, say, a neutral meson, is much larger than that for the bremsstrahlung of mesons. As an example of such a reverse effect, the generation of a scalar and a pseudoscalar meson is examined here, in the cases both of a zero and a nonzero potential well.

1918

NOTE ON THE SELF-ENERGY AND SELF-STRESS. II. Katuro Sawada. Progress Theoret. Phys. (Japan) 5, 236-51 (1950) Mar.-Apr.

The "fermion," a ½-spin particle obeying Dirac's equation, and "boson," a scalar, pseudoscalar, or vector neutral meson, have been investigated in regard to the self-energy and the self-stress of these particles in interaction. Whereas it was found in Part I that the self-stress could be expressed as a surface integral in the $k^{(4)}$ space, it is shown here that the expression can be reduced to that of a two-dimensional surface integral in a $k^{(3)}$ or $l^{(3)}$ space, the numerical values being dependent on the shape of the surface considered.

1919

ON A FORMULA DERIVED FOR THE MASS SPECTROMETER OF ALIKHANOV AND ALIKHANYAN. V. A. Kravtsov. Zhur. Eksptl'. i Teoret. Fiz. 20, 1054-5(1950) Nov. (Letter to the editor; in Russian)

An error is pointed out in a formula used by Alikhanyan et al. (Zhur. Eksptl'. i Teoret. Fiz. 18, 30, 673(1948) in their work on the varitrons. The error may affect the results by 26%.

1920

ON REMARKS MADE BY V. A. KRAVTSOV "ON THE FORMULA DERIVED FOR THE MASS SPECTROMETER OF ALIKHANOV AND ALIKHANYAN." A. Valʹsenberg, V. Morozov, and A. Khrimyan. (Zhur. Eksptl'. i Teoret. Fiz. 20, 1055(1950) Nov. (Letter to the editor; in Russian)

Kravtsov (see preceding abstract) has found an error in a formula derived by Alikhanyan et al. (Zhur. Eksptl'. i Teoret. Fiz. 18, 30, 673(1948)) in their work on varitrons. The present authors, who had collaborated in that work, point out that the error did not affect the numerical findings, inasmuch as this formula was not directly used in the calculation of the results.

NEUTRONS

1921

Brookhaven National Lab. and Argonne National Lab.
REFLECTION OF NEUTRONS FROM MAGNETIZED MIRRORS. D. J. Hughes and M. T. Burgy. Sept. 6, 1950. 40p. (AECU-1059)

The index of refraction for neutrons in ferromagnetic materials has been studied by total reflection from mirrors. It is shown that Bloch's constant, C, is unity, i.e., the effective field for neutrons in a ferromagnet is B. For the

case of total reflection, it is found that the magnetic part of the index is given by the field averaged over a region large compared to the size of the magnetic domains. Completely polarized thermal neutrons have been produced, without the necessity of monochromatization, by reflection from magnetized cobalt. Measurement of the polarization, performed by reflection at a second cobalt mirror, requires careful elimination of reorientation effects in the region between the mirrors. (auth)

1922

Oak Ridge National Lab.
NEUTRON AGE MEASUREMENTS IN GRAPHITE WITH GOLD RESONANCE DETECTION. W. L. Carlson. Sept. 18, 1950. Decl. Oct. 16, 1950. 24p. (ORNL-784)

Results are reported of an experiment to test the validity of the Fermi slowing down theory when applied to neutrons whose energy is less than the chemical binding of the moderator. A monoenergetic source of neutrons of about 24 kev was used and the spatial distribution of 4.8 ± 1 ev (Phys. Rev. 71, 165-173(1947)) gold-resonance neutrons was obtained and compared by the Fermi theory to the 144-ev indium-resonance neutron spatial distribution obtained by Roberts, Hill, and McCammon (ORNL-201). The experimental difference between the indium-resonance and gold-resonance neutron ages is 19 ± 2 cm^2. The calculated age difference between 4.8 ± 0.1 ev neutrons and 1.44-ev neutrons is 18.6 ± 0.3 cm^2. These results then indicate that, within the accuracy of this experiment, the Fermi slowing down model is valid for neutrons slowing down in graphite 4.8 ev to 1.44 ev.

1923

Office of Classification, AEC
NUCLEAR DATA FOR LOW POWER RESEARCH REACTORS. Nov. 16, 1950. 4p. (TID-235)

The atomic energy authorities of Canada, the United Kingdom, and the United States have agreed to the public release of certain information on low-power research reactors, including those nuclear properties of uranium of importance to the design and operation of such reactors. The following are the officially released data: thermal neutron cross sections for uranium; natural uranium fission cross section between 0.7 and 5.0 Mev; neutrons per thermal neutron fission; the prompt neutron-energy spectrum; the fast-fission effect; and the resonance absorption integral.

1924

UPPER AND LOWER BOUNDS FOR THE ASYMPTOTIC NEUTRON DENSITY IN MILNE'S PROBLEM FOR THE SPHERE. W. Seidel and R. E. Marshak. Can. J. Phys. 29, 72-82(1951) Jan.

Rigorous upper and lower bounds for the asymptotic neutron density in Milne's problem for the sphere are calculated by means of an extension of Hopf's method for the plane. (auth)

NUCLEAR PHYSICS

1925

BREMSSTRAHLUNG OF PARTICLES POSSESSING EXTRA-SPIN MAGNETIC MOMENTS. N. N. Kolesnikov and D. I. Blokhintsev. Zhur. Eksptl'. i Teoret. Fiz. 20, 979-86(1950) Nov. (In Russian)

A relativistic examination is made of the electromagnetic radiation that is generated when a nucleus of a magnetic moment μ_1 collides with a particle of spin ½ having an extra-spin magnetic moment μ_2. The interaction studied is that between μ_1 and the total magnetic moment $\mu_2 + \mu_0$ of the particle, where $\mu_0 = e_2h/2Mc$, M is the particle's mass, and e_2 its charge.

1926

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
[EIGHTEENTH PROGRESS REPORT FOR THE THIRD QUARTER OF 1950.] Oct. 1, 1950. 70p. (NP-1879)

Brief references to continuing research on 59 problems distributed according to the following groups are included: chemistry of the fission elements, cosmic ray, elementary particle scattering, 12-Mev generator construction and high-voltage research, nuclear chemistry (inorganic), nuclear chemistry (organic), nuclear cross sections, radioactivity and cyclotron, synchrotron, and theoretical.

1927

ELECTROMAGNETIC RADIATION IN NEUTRON-PROTON COLLISIONS. G. M. Avakyants. Zhur. Eksptl'. i Teoret. Fiz. 20, 944-6(1950) Oct. (In Russian)

In examining phenomenologically the electromagnetic radiation due both to electric forces and magnetic moments that are involved in a collision between protons and fast neutrons, Ashkin and Marshak (Phys. Rev. 76, 58(1949)) believed they had taken into account all the known factors responsible for the generation of that radiation. It is shown that in the Hamiltonian of the system proton-neutron plus electromagnetic field, within the framework of the phenomenological theory, there exist terms which were not accounted for in the work of Ashkin and Marshak and which contribute considerably to the cross section for the radiation. These terms are related to exchange currents appearing during the collision.

1928

EXPERIMENTS ON THE ANGULAR CORRELATION BETWEEN SUCCESSIVE NUCLEAR RADIATIONS. M. Walter, O. Huber, and W. Zünti. Helv. Phys. Acta 23, 697-730 (1950) Dec. 10. (In German)

Several general problems connected with experimentation on angular correlations are discussed, with special emphasis on the effect of the instrument's finite angular resolving power and the corresponding correction formulas. Whereas in the β-γ coincidences of Mn^{56} and Au^{198} the distribution is practically isotropic, As^{76} shows an anisotropy amounting, for a 0.7-mm Al β absorber, to $A = (W(\pi) - W(\pi/2))/W(\pi/2) = 0.08 \pm 0.02$. Successively emitted conversion electrons of Hg^{197} exhibit the strong anisotropy $A = 0.24 \pm 0.03$. 42 references. (auth)

1929

NEUTRON-DEUTERON COLLISIONS AT LOW ENERGIES. Mario Verde. Atti accad. nazl. Lincei Classe sci. fis. mat. e nat. (8) 8, 228-32(1950) Mar. (In Italian)

By treating collisions between two particles as a two-body problem, the dependence of the cross section on the energy of the incident particle is easily deducible for cases of low energies; the method employed is an expansion of ($k \cot \delta_0$) in a power series of k^2 ($k = 2\pi/\lambda$, and δ_0 is the phase constant). In the case of two nucleons, two coefficients of the expansion suffice to cover the energy range 0 to 10 Mev; in other words, only two constants have to be selected (the potential depth and the interaction radius) in order to explain the experimental curve. Consequently, no information is gained as to the form of the nuclear potential, whether, e.g., it is Gaussian or Yukawan. In a former work (Helv. Phys. Acta 22, 339(1949); NSA 3-988) the author has shown that the problem can be solved by resorting to measurements of angular distributions in neutron-deuteron scatterings at low energies. Continuing the argument and treating that process as a three-body problem, he proceeds in the present paper to the expansion in series of powers of k^2, as mentioned.

1930

Purdue Univ.
RESEARCH IN NUCLEAR REACTIONS WITH FAST ALPHA PARTICLES, DEUTERONS, AND NEUTRONS AND A STUDY OF THE STRUCTURE OF COMPLEX NUCLEI; FINAL REPORT. (Technical Report No. IV). Oct. 1, 1950. 77p. (NP-1825)

Detailed results are presented of studies on the following: isomerism of In^{110}; α-particle excitation of stable nuclei; symmetric fission in U^{235}, U^{238}, and Th^{232}; energy spectra of C + D, Be + D, and Li + D neutrons; range-energy relation for Kodak nuclear-track plates; stopping power of metals and semiconductors for fast deuterons; angular correlation of γ rays emitted from the excited states of A^{36}; high-energy radiations from V^{48}; decay of Re^{188}; β spectrum of Rb^{86}; quantum efficiency of Bi counters for electromagnetic radiation of 0.07- to 2.8-Mev energy; a lens-type β-ray spectrometer; and miscellaneous investigations.

NUCLEAR PROPERTIES

1931

ACCURATE MEASUREMENTS OF NUCLEAR MAGNETIC MOMENTS AND ATOMIC CONSTANTS. J. Korringa. Nederland. Tijdschr. Natuurk. 16, 215-20(1950) Sept. (In Dutch)

A critical survey is made of the principal results of measurements of nuclear magnetic moments by the magnetic resonance methods.

1932

FUNDAMENTALS OF NUCLEAR MAGNETIC RESONANCE ABSORPTION. I. G. E. Pake. Am. J. Phys. 18, 438-52 (1950) Oct.

Nuclear resonance absorption technique, as distinguished from that of nuclear induction, and the information which is gained by its use are discussed in such a way as to be of value to the first-year graduate physics student. The nuclear magnet, energy in the magnetic field, flopping torque, relaxation time, spin-spin interaction, and other related concepts are explained. The spin, magnetic moment, and resonant frequency for a field of 10,000 gauss are tabulated for 39 nuclei. 22 references.

1933

INFLUENCE OF MAGNETIC AND ELECTRIC PROPERTIES OF ATOMIC NUCLEI ON THE ENERGY LEVELS OF ATOMS AND MOLECULES. H. B. G. Casimir. Nederland. Tijdschr. Natuurk. 16, 198-206(1950) Sept. (In Dutch)

A general outline is given of hyperfine-structure phenomena. The isotopic effect, the influence of the nuclear magnetic-dipole and electric-quadrupole moments on the structure of spectral lines of atoms, and the effect of the electric quadrupole on the rotational levels of molecules, as revealed in microwave absorption spectra of gases, are examined.

1934

KRAMERS' THEOREM AND NUCLEAR EFFECTS IN PARAMAGNETIC ABSORPTION. C. Kikuchi. Phys. Rev. 81, 155-6(1951) Jan. 1. (Letter to the editor)

After the discovery of the hyperfine structure in solids by Penrose et al. (Nature 163, 992(1949)), Pryce (in Bleaney et al., Nature 164, 116(1949)) has pointed out a relationship between ΔH, the hfs component separation for the Co ion, and the angle between the crystalline axis and the applied magnetic field. An investigation is made here of the conditions under which Pryce's relation is valid. It is pointed out that his relation is a consequence of Kramers' theorem (Proc. Acad. Sci. Amsterdam 35, 1272(1932)) when the effect of nuclear magnetic moment is taken into account to the first approximation.

1935

MAGNETIC RESONANCE OF ATOMIC NUCLEI. C. J. Gorter. Nederland. Tijdschr. Natuurk. 16, 207-14(1950) Sept. (In Dutch)

Principles underlying magnetic-resonance methods of determination of nuclear magnetic moments and atomic constants are surveyed.

1936

ON THE DETERMINATION OF REDUCED WIDTHS FROM THE ONE-LEVEL DISPERSION FORMULA. R. G. Thomas. Phys. Rev. 81, 148-9(1951) Jan. 1. (Letter to the editor)

It is pointed out that a common approximation used in applying the one-level nuclear dispersion formula to the determination of reduced level widths may be unjustified in the case of broad levels, which are numerous in light nuclei. The one-level dispersion formula usually applied to the determination of reduced level widths is that of Wigner and Eisenbud (Phys. Rev. 72, 29(1947)), and the common approximation is to neglect the variation of the level shift with respect to the energy of the incident particle. This variation is shown to be important in some cases. An example cited is the 456-kev resonance in the $C^{12}(p,\gamma)$ reaction.

1937

SHELL STRUCTURE OF ATOMIC NUCLEI. P. F. A. Klinkenberg. Nederland. Tijdschr. Natuurk. 16, 221-34 (1950) Oct. (In Dutch)

In an outline of the existing shell-model theories of nuclear structure, the empirical relationships formulated by Schmidt (Z. Physik 106, 358(1937)) and the models proposed by Nordheim (Phys. Rev. 75, 1894(1949)), Feenberg and Hammack (Phys. Rev. 75, 1877(1949)), Goeppert Mayer (Phys. Rev. 75, 1969(1949)), and Haxel, Jensen, and Suess (Phys. Rev. 75, 1766(1949)) are discussed.

NUCLEAR REACTORS

1938

Brookhaven National Laboratory
THE BROOKHAVEN NUCLEAR REACTOR. Lyle B. Borst. [nd.] 18p. (AECU-1089)

A brief, general description of the air-cooled, graphite-moderated nuclear reactor at Brookhaven National Laboratory with its laboratory facilities, planned research programs, and accessibility for unclassified research is presented. The control room, experimental face of the reactor, pneumatic system for short exposure, and a section of the shield are illustrated.

1939

NEW NUCLEAR REACTOR APPROVED FOR CHALK RIVER. Can. Chem. Process Inds. 35, 40-3(1951) Jan.

Details of recently declassified information on atomic energy data pertaining to the design, construction, and operation of low-power reactors as applied to Canada's atomic energy project are reported. The NRX reactor, the "rabbit," the ZEEP (zero energy experimental pile), radioisotopes and their use, Van de Graaff generator, etc., are discussed.

NUCLEAR TRANSFORMATION

1940

Clinton Lab.
DIFFUSION AND PRODUCTION OF NEUTRONS BY PHOTON IN D_2O. E. Greuling, P. O. Levy, H. C. Schweinler, and H. Soodak. June 1946. Decl. Dec. 5, 1950. 2p. (AECD-3025; MonP-130(Physics Section II))

The neutron yield resulting from the photodisintegration of deuterium in heavy water was calculated using specified approximations. The numerical results are summarized in the following table:

D_2O sphere radius, cm	Neutron yield from 1st collision, %	Neutron yield from 2nd and higher collision, %
25	0.183	0.014
∞	0.336	0.078

1941

Carbide and Carbon Chemicals Corp., K-25
PHOTONEUTRON FISSION ANALYSIS FOR U-235 IN HIGH PURITY U-238. R. L. Macklin and J. H. Lykins. Aug. 1, 1949. 4p. (AECD-3029; KAE-40; A-3654(Rev.))

The photoneutron method for the analysis of U^{235} in high-purity U^{238} is described. Special samples have been found to contain as little as 5 ppm U^{235}. An upper limit for the thermal-neutron fission cross section of U^{238} can be set at 5×10^{-28} cm². (auth)

1942

Argonne National Lab.
ACTIVATION CROSS SECTIONS MEASURED WITH ANTIMONY-BERYLLIUM PHOTONEUTRONS. Virginia Hummel and Bernard Hamermesh. Nov. 1950. 6p. (AECU-1092; UAC-328)

Results of a program of activation cross section measurements using photoneutrons from an Sb-Be source are reported. In most cases, the materials to be studied were in the form of metal foils. The isotopes studied, together with the half-life of the isotope that is formed by the neutron capture, and the results obtained for the natural atom cross section for the reaction at the energy of the neutrons from the Sb-Be source have been listed. The last column lists the per cent error of the measurements relative to values given by Seren (Phys. Rev. 72, 888(1947)).

1943

Radiation Lab., Univ. of California
OBSERVATIONS ON LITHIUM AND BERYLLIUM NUCLEI EJECTED FROM HEAVY NUCLEI BY HIGH ENERGY PARTICLES. Luis Marquez and I. Perlman. Nov. 17, 1950. 21p. (UCRL-667 (Rev.))

The yields of Be^7 produced by 335-Mev protons on nuclei of different atomic number have been determined and found to decrease with increasing atomic number. Reactions are described in which the irradiation of an element with protons or α particles results in products higher by 3 in atomic number. These reactions are interpreted tentatively as second-order processes in which the initial step is the production of high-energy Li nuclei which in turn cause nuclear reactions of the type (Li,xn). From the observed over-all yields, deductions are made as to the cross sections for the separate steps. (auth)

1944

EXCITATION OF NUCLEI BY FAST ELECTRONS. K. Ter-Martirosyan. Zhur. Eksptl'. i Teoret. Fiz. 20, 925-36(1950) Oct. (In Russian)

The probability of excitation of a nucleus under the action of fast electrons is calculated. The cross section of the "zero" transition is determined with the aid of exact functions of the Coulomb field; for the general case of a 2^n-pole transition, an expression is derived giving the cross section in the Born approximation and a study is made of the influence of the nuclear field on the probability of excitation in the neighborhood of the reaction's threshold. (auth)

1945

EXPERIMENTS ON THE NUCLEAR PHOTOEFFECT. Yu. Khokhlov. Uspekhi Fiz. Nauk 42, 316-21(1950) Oct. (In Russian)

This is a review of works on nuclear photoreactions, published since November 1948. Several general conclusions that can be drawn from these experiments concerning cross-section maxima and their dependence on the atomic number of the nucleus hit, and on the energy of the impinging photon, are presented. 17 references, mostly from Phys. Rev.

1946

γ-RAYS PRODUCED BY SLOW NEUTRON CAPTURE IN BERYLLIUM, CARBON, AND NITROGEN. B. B. Kinsey, G. A. Bartholomew, and W. H. Walker. Can. J. Phys. 29, 1-13(1951) Jan.

The γ rays produced by slow-neutron capture in Be, C, and N have been investigated with a pair spectrometer. Only one γ ray was observed to follow capture in Be and in C; nine were observed in N. The neutron binding energies computed from the energies of these radiations are Be^{10}, 6.797 ± 0.008 Mev; C^{13}, 4.948 ± 0.008 Mev; N^{15}, 10.823 ± 0.012 Mev. The N γ rays can be fitted into a term scheme containing the previously known excited states of N^{15}, obtained from the study of (d,p) reactions, together with one excited state at 9.16 Mev, hitherto unreported. A comparison of the intensities of the N and Be radiations shows that the radiative-capture cross section of N is at most 160 millibarns. (auth)

1947

PHOTOELECTRIC DISSOCIATION OF THE DEUTERON. C. H. Collie, H. Halban, and R. Wilson. Proc. Phys. Soc. (London) 63A, 994-1009(1950) Sept. 1.

The cross section for the photodisintegration of the deuteron has been measured by detecting the photoprotons formed in a high-pressure ionization chamber. The values obtained are 13.91 ± 1 × 10^{-28} cm^2 for 2.62 Mev γ rays from radiothorium and 15.6 ± 1 × 10^{-28} cm^2 for the 2.76 Mev γ rays from radiosodium (Na^{24}).

1948

REACTIONS BETWEEN NUCLEONS AND MESONS, AND THE SEARCH FOR NEGATIVE PROTONS. Louis Michel. Nature 166, 654-5(1950) Oct. 14. (Letter to the editor)

Since the rest energies of a neutron and an electron are together greater than that of the proton by 1.826 Mev, several authors have suggested that negative protons may be emitted from β^- radioactive nuclei which emit a delayed neutron, and some unsuccessful attempts at detection have been made. Using the concept of classes of reactions (sets of all possible reactions between certain particles, in this case neutrons, positive and negative protons, and positive, negative, and neutral mesons) the present author shows that certain classes are excluded by the impossibility of the reactions $p^+ + n^0 = \pi^+$ and $n^0 + n^0 = \pi^0$ (since their occurrence would not be compatible with the existence of atomic nuclei). The other classes involve the creation or the annihilation of a pair of one nucleon and one antinucleon, and therefore rule out the stable existence of antinucleons in nuclei. Furthermore, with these classes of reactions an assembly of n antinucleons and $\leq A - n$ nucleons cannot be obtained from a nucleus with A nucleons, even with an arbitrary number of intermediate virtual reactions. Hence it is impossible to observe the spontaneous emission of p^- (or n with positive magnetic moment) from an atomic nucleus.

1949

REMARK ON NUCLEAR DECAYS IN AN ELECTROMAGNETIC FIELD. K. Ter-Martirosyan. Zhur. Eksptl'. i Teoret. Fiz. 20, 937-40(1940) Oct. (In Russian)

The relationship is examined between cross sections for nuclear decay reactions produced by γ quanta, by fast electrons, and by the electric field of a heavy particle passing in the neighborhood of the nucleus. The cross section for the disintegration of Be^9, caused by a collision with a heavier nucleus, is calculated. (auth)

1950

THRESHOLDS OF PHOTO-NEUTRON REACTIONS. R. Sher, J. Halpern, and W. E. Stephens. Phys. Rev. 81, 154-5(1951) Jan. 1. (Letter to the editor)

Neutron yields as functions of the maximum energy of the bremsstrahlung output of the betatron were measured for several substances in the energy region from threshold to 22 Mev. The samples were inserted in a block of paraffin, in which was also placed a $B^{10}F_3$ counter. The energy scale was calibrated using photodisintegration thresholds of D, Cu^{63}, and C^{12}. Thresholds were determined by plotting the square root of the neutron yield as a function of energy in the region around threshold. The experimental errors in most cases are ±0.3 Mev. The advantage of detecting neutrons rather than residual radioactivities is the possibility of finding (γ,n) processes whose products are either stable or have very long or very short half-lives. On the other hand, the identification of some of the isotopes involved becomes more doubtful.

PARTICLE ACCELERATORS

1951

Brookhaven National Lab.
ELECTRON LOADING IN ION ACCELERATING TUBES I. (abstract). C. M. Turner, [nd.] 1p. (AECU-1063)

The report is reproduced here in its entirety.

A new, or at least newly recognized, phenomenon has been encountered in ion accelerating tubes having internal diameters larger than normally used heretofore. This phenomenon is that of "electron loading" or back electron current appearing under suitable conditions of voltage and vacuum, and has been a source of difficulty in tubes built for both of the Brookhaven electrostatic accelerators. The outstanding characteristics of this phenomenon are the following: (a) It sets in at a definite voltage threshold as evidenced by the sudden appearance of x rays and increased current drain. (b) It increases approximately as the sixth power of the voltage, and hence acts as an effective voltage limiter. (c) The threshold is found to be sharply dependent on tube

pressure, increasing with increasing tube pressure. (d) H_2, He, N_2, and A affect the threshold in approximate proportion to the mass of gas present. Numerous tests suggest that the electrons in question are emitted from regions at the cathode end of the tube where field lines from the tube terminate. A possible mechanism to account for this emission is discussed in Part II of this report (AECU-1064).

1952

Brookhaven National Lab.
ELECTRON LOADING IN ION ACCELERATING TUBES II. (abstract). John P. Blewett. [nd.] 1p. (AECU-1064)

The report is reproduced here in its entirety.

Experiments described in Part I of this report (AECU-1063) indicate that the spurious electron emission observed in positive ion accelerating tubes is a surface effect and is associated with surface layers of reasonably volatile materials, probably pump oils or other organic vapors. These phenomena have been reproduced in a parallel plane diode whose electrodes were about 1 mm apart. The electron currents appeared in the range between 2 and 30 kv so that the fields were of the order of tens of kilovolts per centimeter. Fields of this order appear at the electrodes of conventional Van de Graaff accelerating tubes. The electron current varied about as the sixth power of the voltage just as in the case of the current observed at high voltages. The effect depends on field, not total voltage; it is relatively independent of temperature around room temperature; and it is strongly affected by surface contaminations. Arguments will be presented to show that this effect is identical with the Malter effect.

1953

Atomic Energy Research Establishment
CALCULATION OF BETATRON ORBIT CONTRACTION FROM THE MAGNETIC CHARACTERISTICS OF BETATRON BAR MATERIALS. J. J. Wilkins. Aug. 17, 1948. 8p. (AERE-TRE-Memo-G/M-110)

The analysis in this note has resulted in equations by means of which the suitability of any proposed betatron bar material may be readily assessed. The cross-sectional area of bar required to limit the rate of betatron orbit contraction to any specified extent may be deduced from the known hysteresis loop of the material. It is found that, in the higher energy betatron-synchrotrons such as the 140 and 375 Mev machines, a high-grade material, having both high initial permeability and high saturation density, is required to keep the bar cross section down to reasonable values. The use of negative d-c bias is of some advantage, but may involve a certain amount of orbit expansion in the initial stages of acceleration.

1954

Commissariat à l'Énergie Atomique
CURRENT REGULATOR FOR STABILIZING ELECTROSTATIC GENERATORS. A. Gabet and J. Taieb. 1950. 25p. (In French). (CEA-46)

An instrument consisting of two electronic tubes, a triode and a pentode, connected in series, serves as a stabilizer of the current that charges a working model of a Van de Graaff generator. The current is maintained at a level corresponding to an auxiliary variable voltage. The triode maintains that voltage, while the pentode regulates the current. Another application of the circuit, viz., the stabilizing of the generator voltage, will be described elsewhere.

1955

DESIGN AND CONSTRUCTION OF A BILLION-VOLT LINEAR ELECTRON ACCELERATOR. Marvin Chodorow, E. L. Ginzton, John Jasberg, Robert Kyhl, Richard Neal, and Paul Pearson. Paper presented at the 1951 Institute of Radio Engineers National Convention, New York, Mar. 19-22.

An abstract of this paper appeared in Proc. I.R.E. 39, 309(1951) Mar. and is reproduced here in its entirety.

This paper concerns the design and construction of the first 80 ft of a 220-ft linear accelerator to produce billion-volt electrons. The accelerator operates at a frequency of 3000 megacycles, and the power is supplied by klystrons, each delivering 10 megawatts of pulse power fed into the accelerator at intervals of 10 ft. The klystrons are run as amplifiers to insure proper phase relations in the separate operating sections. Various components of the accelerator and preliminary results are described.

1956

MAGNETIC ACCELERATORS OF PARTICLES. M. Perroy. J. radiol. électrol. 31, No. 7-8, 477-81(1950). (In French)

The working principles of the cyclotron, the betatron, the synchrotron, and the microtron (a resonant cavity electron accelerator) are outlined.

1957

SUMMARIZED PROCEEDING OF CONFERENCE ON HIGH-INTENSITY X-RAY BEAMS — LONDON, APRIL 1950. A. E. De Barr and I. MacArthur. Brit. J. Applied Phys. 1, 305-18(1950) Dec.

The Annual Spring Conference of the X-ray Analysis Group of the Institute of Physics was held in London on 13-14 April, 1950. The subject was "The production and application of high-intensity x-ray beams." Sixteen papers, together with a number of shorter contributions, were given and are summarized in this report. High-intensity x-ray generators, fine foci, high-power x-ray tubes, high-intensity beams in the progress of x-ray analysis, monochromators and collimators, applications of high-intensity x-ray beams, and the structure of cold-worked metals have been considered. 84 references.

1958

A 300- TO 4,000-KILOCYCLE ELECTRICALLY TUNED OSCILLATOR. A. I. Pressman and J. P. Blewett. Proc. I.R.E. 39, 74-7(1951) Jan.

In designing the 3-bev cosmotron at Brookhaven, it was decided that the severe tuning, timing, and magnetic field-tracking specifications could more easily be met by an electronically, rather than a mechanically, swept oscillator. Such an oscillator is described whose frequency is electrically controllable over a 13-to-1 frequency range.

Tuning is accomplished by saturation of a ferromagnetic core in the inductance of the tank circuit. The output is constant in amplitude to within 4% and is reproducible in frequency to better than 0.1%.

1959

TIMING UNIT AND PULSE DEFLECTOR GENERATOR FOR 145-INCH SYNCHROCYCLOTRON. E. M. Williams, C. H. Grace, and L. W. Johnson. Paper presented at the 1951 Institute of Radio Engineers National Convention, New York, Mar. 19-22.

An abstract of this paper appeared in Proc. I.R.E. 39, 309(1951) Mar. and is reproduced here in its entirety.

The 145-in. Carnegie Institute of Technology synchrocyclotron employs an electrostatic beam deflector. This deflection system requires a pulse of approximately 60 kv, 10 megawatts peak power, and 0.036 μsec duration. The pulse is timed to a fraction of a cycle of the r-f accelerating voltage or with an accuracy of about 0.01 μsec. Details of the timing circuits, a novel cascade cavity-enclosed hydrogen-thyratron pulser, and test results are described. Factors affecting timing accuracy are discussed in detail.

RADIATION ABSORPTION AND SCATTERING

1960

Brookhaven National Lab.
GENERAL THEORY OF CASCADE SHOWERS. (abstract). W. T. Scott. Dec. 12, 1950. 1p. (AECU-1053)

The report is reproduced here in its entirety.

A general approach to the stochastic problem of cascade showers is presented, using a simplified model for illustration. The work of Bhabha (Proc. Roy. Soc. (London) 202A, 301(1950)) is extended to show how all statistical information about a shower may be found in principle from the average energy spectrum. Jánossy's method of generating functions (Proc. Phys. Soc. (London) 363A, 241(1950)) is used, in connection with Friedman's adjoint theory using the energy spectrum as a Green's function (M.I.T. Lab. Nucl. Sci. Eng., Technical Report 31, (1949)) to summarize these results. An appropriate foundation is thus presented for further work on the problem of the distribution in number of particles at a given depth in the shower.

1961

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 25, 1950. Henry P. Kramer. Sept. 18, 1950. 9p. (UCRL-890)

Bevatron Progress Report. The status of the following are indicated: building, design of pole pieces, removal of residual magnetic fields, evacuation of the beam space, preacceleration and injection, etc.

Search for Compton Scattered Protons. Utilizing the high intensity of x rays from the synchrotron and refined detecting apparatus, a search was made for Compton scattering by protons. Evidence is presented to show that proton-photon coincidences observed are not due to Compton scattering. Observed data is interpreted as evidence for the creation of neutral mesons, the protons being the recoils in the process, and the observed γ rays coming from the decay of the neutral mesons.

Rare Earth α Emitters. Alpha activity is reported in artifically produced rare-earth isotopes including those with a Z of 62 to 67. It had not previously been observed for elements with Z less than 84 (Po) excepting Sm.

1962

CHEMICAL BONDS OF PROTONS MEASURED WITH A VELOCITY SELECTOR FOR NEUTRONS. R. Keller. Helv. Phys. Acta 23, 627-50(1950) Dec. 10. (In French)

A note under the same title appeared in Helv. Phys. Acta 23, 522(1950), and has been listed in Nuclear Science Abstracts as abstract 5-1380.

1963

COMPUTATION OF HIGHER APPROXIMATIONS IN THE SCATTERING OF FAST ELECTRONS. Zh. S. Takibaev. Zhur. Eksptl'. i Teoret. Fiz. 20, 898-904(1950) Oct. (In Russian)

A general method is discussed of the computation of higher approximations in describing collisions between electrons, insofar as classical electro-dynamics can be applied to the problem. A formula is obtained giving, to the forth approximation, the energy transmitted to the δ electron. (auth)

1964

EFFECT OF THE DISSOCIATION OF THE NUCLEON ON THE ELASTIC SCATTERING OF ELECTRONS. G. S. Saakyan. Zhur. Eksptl'. i Teoret. Fiz. 20, 871-6(1950) Oct. (Letter to the editor; in Russian)

Differential cross sections for elastic scattering of electrons of $\geq$ 100-Mev energy must suffer a decrease at large angles through the influence of the virtual disintegration of nucleons according to processes $P \rightarrow N + \mu^+$ and $N \rightarrow P + \mu^-$. The maximum decrease is about 40%. Measurements of this effect should furnish valuable information on the meson field in the vicinity of the nucleon, viz., on the mass, magnetic moment, and the effective radius of the meson "cloud" around the nucleon. In order to account for the effect, Mott's formula was refined accordingly and an allowance made for the energy transmitted to the nucleon. (auth)

1965

ON THE INFLUENCE OF THE SPIN INTERACTION ON THE SCATTERING OF MESONS AND ELECTRONS BY LIGHT NUCLEI. E. Amaldi, G. Fidecaro, and F. Mariani. Nuovo cimento (9) 7, 757-73(1950) Sept. 25.

As an extension of a previous work (Nuovo cimento (9) 7, 553(1950)) the electromagnetic collision of a particle of spin ½ with a light nucleus, represented by a one-particle model, is treated in the first Born approximation. The differential cross sections for coherent and incoherent scatterings against Li and C nuclei are calculated for μ mesons of 200 and 600 Mev and for electrons of 300 Mev; the results are compared with those of the previous paper, where the spin of the incident particle was neglected. The question is discussed of the contribution of the neutrons of

the nucleus to the scattering, the finite dimensions of the observed nucleons being taken into consideration. (auth)

1966

THE SCATTERING LENGTHS OF THE DEUTERON. D. G. Hurst and N. Z. Alcock. Can. J. Phys. 29, 36-58 (1951) Jan.

The angular variation of the scattering of neutrons of 0.0724-ev energy by deuterium gas has been measured. Comparison with theoretical calculations of this variation gives a ratio of scattering lengths: $a_{1/2}/a_{3/2} = 0.12 \pm 0.04$ or 3.2 ± 0.3. In combination with the known total scattering cross section of the free deuteron of 3.44 ± 0.06 barns this gives for the scattering lengths the two sets of values:

$$a_{1/2} = (0.07 \pm 0.03 \text{ or } 0.826 \pm 0.012) \times 10^{-12} \text{ cm}$$
$$a_{3/2} = (0.638 \pm 0.006 \text{ or } 0.26 \pm 0.02) \times 10^{-12} \text{ cm}$$

(auth)

1967

SIMULTANEITY IN THE COMPTON EFFECT. Uspekhi Fiz. Nauk 42, 315-16(1950) Oct. (In Russian)

A short outline is given of the attempts to observe simultaneously the Compton ray and the corresponding recoil electron; of the controversy on the applicability of conservation laws to elementary scattering processes, which arose from those experiments; and of the recent observations by Hofstadter et al. (Phys. Rev. 78, 24(1950)) reaching an accuracy of the order of 10^{-8} sec in the proof of the simultaneity, thereby improving the latest previous attempt by four orders of magnitude.

RADIATION EFFECTS

1968

ELECTRON-CURRENT PULSES PRODUCED BY α PARTICLES IN NaCl CRYSTALS. Horst Witt. Z. Physik 128, 442-50(1950) Oct. 3. (In German)

Current pulses produced by single α particles in NaCl crystals were measured. The pulse intensity grows with the potential applied. In the presence of color centers acting as electron captors, the pulse intensity is inversely proportional to the color-center concentration, provided the latter is high enough. The ratio between dissociation probabilities for the production of secondary electrons by β and α particles in alkali halide crystals $Z_\beta/Z_\alpha = 10$. In a field of 1.5×10^7 v/m, at least 90% of electrons freed by α particles recombine, while the remainder traverse the crystal entirely. (auth)

1969

SCINTILLATIONS FROM THIN FILMS. E. W. T. Richards and J. F. I. Cole. Nature 167, 286(1951) Feb. 17. (Letter to the editor)

The emission of light pulses from thin films under α-particle bombardment was investigated. In all cases, irrespective of the material used, light pulses were observed to be emitted from those films the thickness of which did not exceed the range of the α particle in the material. The following materials were included in the investigations: sulfur, iodine, carbon, nickel sulfate, sodium chromate, stannous chloride, mercuric iodide, aluminum, copper, tungsten, iron, nylon, glass, mica, and collodion. None of these materials is normally considered to be a phosphor, the effect being entirely confined to films which are thin with respect to the α-particle range. The efficiencies of all these films are approximately the same with respect to pulse height and the number of counts obtained. For purely experimental reasons, nylon films were chosen for a more detailed examination. This included a comparison between the efficiencies of a single nylon film of 0.48-mm air equivalent, and a ZnS screen. It was found that the counting efficiency of the nylon film was reduced by a factor of 200 and the pulse height by about 25. Graphic presentations of a pulse-height distribution for a single nylon film and of data on the effect of film thickness on the counting efficiency are shown.

RADIOACTIVITY

1970

Radiation Lab., Univ. of California
PART A. AN X-RAY SPECTROMETER FOR USE IN RADIOACTIVITY MEASUREMENTS, THE L X-RAYS OF NEPTUNIUM AND PLUTONIUM; PART B. SOME LIGHTER ISOTOPES OF ASTATINE. G. W. Barton. May 3, 1950. Decl. July 25, 1950. 72p. (AECD-3010; UCRL-670)

A bent-crystal-focusing x-ray spectrometer has been designed and built for the observation of the x and γ rays emitted in association with radioactive decay. The instrument uses proportional counter detection. The instrument and the associated electronic circuits are described. The plutonium L x rays from Cm^{242} and the neptunium L x rays from Am^{241} have been measured. Values of the energies and abundance are reported. Some isotopes of astatine hitherto unreported (At^{201} and At^{203} to At^{209} inclusive) have been observed in bombardments of bismuth on the University of California 184-in. cyclotron.

1971

Argonne National Lab.
HALF-LIFE AND ALPHA-PARTICLE ENERGY OF U^{236}. A. H. Jaffey, H. Diamond, A. Hirsch, and J. Mech. Apr. 1950. Decl. Dec. 13, 1950. 4p. (AECD-3026; ANL-WMM-661)

The average half-life value from three samples containing U^{236} was $2.45_7 \times 10^7$ years. The average of nine measurements of α-particle energy value gave 4.499 ± 0.004 Mev (mean deviation).

1972

Michigan Univ. and Argonne National Lab.
ELECTRON SPECTRUM OF Pa^{233}. H. B. Keller and J. M. Cork. May 9, 1950. Decl. July 11, 1950. 6p. (AECD-3034)

A permanent-magnet-type photographic β spectrometer was employed. Field strengths of approximately 200 and 600 gauss were used, which made it possible to cover continuously the energy range from 19 kev to 1.5 Mev. In all, 46 conversion and 3 weak Auger lines were observed; all

of these are confined to energies less than 411 kev. Absorption of the γ rays in Pb revealed no γ radiation harder than 400 kev. Absorption in Be and Al gave a β end point agreeing with that found by Haggstrom (Phys. Rev. 59, 322(1941)) and Levy (Phys. Rev. 72, 352(1947)), but no trace of a harder β component such as that reported by Fulbright (P.P.R. CP-1954, Aug. 1944). A proposed energy-level scheme for U^{233} is given.

1973

Argonne National Lab.
THE RADIATIONS OF Ce^{141} AND Pa^{233}. M. S. Freedman and D. W. Engelkemeir. [nd.] Decl. June 9, 1950. 9p. (AECD-3035; ANL-HDY-674)

Results of experimental studies of the radiations from Ce^{141} and from Pa^{233} are reported and compared with other results in extensive references. Graphic presentations of the momentum spectrum of Ce^{141}, a Kurie plot of the Ce^{141} spectrum (relativistic Fermi function used), and the decay scheme of Ce^{141} are included. 18 references.

1974

Brookhaven National Lab.
GAMMA-RADIATION FROM Pb^{206}. D. E. Alburger and G. Friedlander. Oct. 10, 1950. 18p. (AECU-1056)

Gamma rays accompanying the electron-capture decay of 6.4-day Bi^{206} and the α decayœof 138-day Po^{210} have been observed by measurement of internal-conversion electrons and photoelectrons with a lens spectrometer. The Bi activity showed resolved lines corresponding to γ rays of 182, 234, 260, 341, 396, 470, 505, 536, 590, 803, 880, 889, 1020, 1097, and 1720 kev. A thin Po^{210} source of 480-mc α-particle strength was found to emit γ rays of 800 ± 6-kev energy which yielded K and L internal-conversion lines in the ratio of 3.7 ± 0.5 to 1. The 803-kev γ ray observed in both the Bi^{206} and Po^{210} activities is identified with a transition from the first excited state of Pb^{206} to the ground state. (auth)

1975

Radiation Lab., Univ. of California
DECAY SCHEME OF Mo^{99}. (abstract). H. Medicus, D. Maeder, and H. Schneider. Oct. 30, 1950. 1p. (UCRL-973)

The report is reproduced here in its entirety.

Beta decay of Mo^{99} proceeds in practically all cases by way of excited levels in Tc^{99}. About 87% of the transitions (β_{max} = 1.225 ± 0.015 Mev) lead to the well known isomeric level of Tc with 6-hr half-life (Seaborg and Segrè, Phys. Rev. 55, 808(1939)) which lies 143 kev above the ground state. This will be reached by a cascade consisting of a highly converted 1.8 ± 0.3 kev transition (to which the isomeric behavior is to be attributed) and of a γ ray of 141.2 ± 0.5-kev energy of low multipole order (conversion coefficient α = 0.095 ± 0.020, $[\alpha_K : \alpha_L : \alpha_{M+N} = (7.9 \pm 0.5) : 1 : (0.30 \pm 0.03)]$. About 13% of the transitions of Mo^{99} lead to an excited Tc level of 969 kev. Thence the 141.2-kev level is reached directly by emission of a 728 ± 8-kev γ ray whereupon transition to the ground state follows. Very weak γ rays were also found with energies of 182 ± 3 and 360 ± 6 kev. The expected β transition from isomeric Tc^{99} to the ground state of Ru^{99} could not be observed. Its probability must therefore be smaller than that of the isomeric transition by a factor of 3.10^{-4}.

1976

THE ANGULAR CORRELATION OF ANNIHILATION RADIATION. P. E. Argyle and J. B. Warren. Can. J. Phys. 29, 32-5(1951) Jan.

The angular distribution of annihilation radiation from Cu^{64} has been measured with a pair of scintillation counters in coincidence. Coincidences were found when the counters and source were not quite collinear. The relation between the noncollinear coincidence rate and angle of deviation λ could be closely approximated by an exponential of the form $e^{-\lambda/\lambda_0}$ where $\lambda_0 = (3.60 \pm 0.04) \times 10^{-3}$ radian. Interpreting this departure from antiparallelism of the two photons as arising from the residual motion of the annihilating pair, the average momentum of their mass center in copper is found to be 7.20×10^{-3} mc which corresponds to an electron energy of 13.2 ev, if the positron is assumed to be thermalized before annihilation. (auth)

1977

EXPERIMENTAL EVIDENCE FOR THE THREE-PHOTON ANNIHILATION OF AN ELECTRON-POSITRON PAIR. J. A. Rich. Phys. Rev. 81, 140-1(1951) Jan. 1. (Letter to the editor)

The three-photon annihilation radiation of Cu^{64} was detected with three scintillation counters (anthracene and naphthalene) arranged symmetrically about the source and connected in triple coincidence, the coincidence circuit resolving time being 5×10^{-7} sec. The ratio of the cross sections for the two-photon and three-photon annihilation processes was found to be $(2.0 \pm 0.4) \times 10^2$ or $(3.3 \pm 0.7) \times 10^2$, depending on the assumption made concerning the relative efficiency of the detector for the radiations involved. Calculations of the relative frequency of occurrence of the three-photon annihilation process as compared with the two-photon process have been made by Lifshits (Doklady Akad. Nauk S.S.S.R. 60, 211(1948)), who obtained 1/235, and by Ore and Powell (Phys. Rev. 75, 1696(1949)), who found 1/370.

1978

ON THE RELATIONSHIP BETWEEN THE HALF-LIFE OF A K CAPTURE AND THE ENERGY OF THE γ RADIATION. V. Belosel'skiĭ. Doklady Akad. Nauk S.S.S.R. 75, 793-5 (1950) Dec. 21. (In Russian)

An attempt is made to find an empirical relationship between the half-life periods of K captures and the only characteristic energy data known so far for these processes, viz., the energy of the emitted γ radiation. If logarithms of half-lives are plotted against the energy of the quanta, all points appear to be distributed upon several almost parallel, down-sloping, straight lines. The following regularities becomes apparent: nuclei with even numbers Z of protons and odd numbers N of neutrons are present on all lines; those with odd Z are forbidden on

some lines but allowed on others, depending on the parity of N; and those with even Z and N are forbidden on all lines.

1979

ON THE THEORY OF THE DOUBLE β DECAY. L. A. Sliv. Zhur. Ekspti'. i Teoret. Fiz. 20, 1035-8(1950) Nov. (In Russian)

A calculation of the probability of the double β decay of even-even nuclei shows that the spectrum of the electrons is the same for all interaction variants and that the mean life of the nuclei undergoing such decays is of the order of 10^{18} yr. (auth)

SPECTROSCOPY

1980

RAMAN SPECTRUM OF RUTILE (TiO_2). P. S. Narayanan. Proc. Indian Acad. Sci. 32A, 279-83(1950) Oct.

The Raman spectrum of rutile, TiO_2, has been recorded using the visible radiations of the mercury arc. The 8 observed Raman lines have been partially explained on the basis of an elementary group-theoretical analysis. (auth)

THEORETICAL PHYSICS

1981

ANGULAR WAVE FUNCTIONS OF PARTICLES WITH SPIN. V. B. Berestetskiĭ, A. Z. Dolginov, and K. A. Ter-Martirosyan. Zhur. Ekspti'. i Teoret. Fiz. 20, 527-37(1950) June. (In Russian)

In certain problems involving angular wave functions of particles with spin ½ (electron) or 1 (photon), these functions are conveniently expressed in terms of spinor and vector spherical functions. Spherical spinors (or semivectors) were introduced by Fok ("Principles of Quantum Mechanics," 1932 (In Russian)) for the representation of the relativistic wave function of an electron with a given momentum, while spherical vectors were first used by Petrashen' (Doklady Akad. Nauk 46, 291(1945)) for the solution of certain boundary problems, and by Sorokin (Zhur. Ekspti'. i Teoret. Fiz. 18, 228(1948)) and Berestetskiĭ (ibid. 17, 12(1947); Dissertation, Institut Fizicheskikh Problem, Akademii Nauk S.S.S.R., Moscow, 1948 (In Russian)) for the determination of multipole fields (the latter writer applied properties of rotation groups for the construction of spherical vectors and spinors). After giving a general definition of spherical (L,l)-vector functions, the present author shows how they can be used for an expansion of an L vector. Several examples of applications of spherical vector and semivector functions are examined. Thus, the solution of Dirac's equation describing the motion of an electron with a given momentum is represented by a superimposition of functions corresponding to definite values of angular momenta. (auth)

1982

BOSON CURRENT CORRECTIONS TO SECOND ORDER. D. C. Peaslee. Phys. Rev. 81, 94-106(1951) Jan. 1.

The β-matrix formalism is applied to the Schwinger-Tomonaga method of calculating second-order current corrections for particles with spin 0 or 1 in interaction with the electromagnetic field. A rule for eliminating the troublesome "surface terms" is introduced, which makes the general formalism exactly similar to that for the electron. One other complication is the appearance in the results of an opeartor M which has no counterpart in the electron case; this operator can be handled without difficulty, however. The second-order current corrections are found to diverge logarithmically for the vector meson, including the corrections to the dipole and quadrupole moments. For the scalar meson, on the other hand, the divergent terms vanish identically because of special relations between the operators. Thus to this order of calculation, the scalar meson, like the electron, requires only renormalization of the charge and mass, while the same is no longer true of the vector meson. (auth)

1983

COLLISION CROSS SECTIONS OF METAL SCREENS. Giuliano Toraldo di Francia. Atti accad. naz. Lincei. Classe sci. fis., mat. e nat. 8, 369-73(1950) Apr. (In Italian)

The behavior of electromagnetic waves colliding with an infinitely thin plane metal conductor having a finite aperture, is examined. It is found that the screen's cross section for collision with a wave of a given polarization is twice as large as the cross section for transmission (through the aperture) of a wave polarized perpendicularly to the former. It follows that the collision cross section of a finite screen, whose dimensions are much larger than the wavelength, is twice the screen's geometrical section. This fact, first noted by Massey and Mohr (Proc. Roy Soc. (London) 141, 434(1933)) for a scalar case of a sphere, was explained by Bohr on the basis of Babinet's principle (Storruste and Wergeland, Kgl. Norske Videnskab. Selskabs Forh. 21, No. 10 (1948)).

1984

COMPUTATION OF MATRIX ELEMENTS OF THE H ATOM WITH THE AID OF THE LAPLACE TRANSFORMATION. (A CONTINUATION OF "A NEW METHOD FOR THE TREATMENT OF WAVE-MECHANICAL PROBLEMS.") H. Kallmann and M. Päsler. Z. Physik 128, 347-65(1950) Oct. 3. (In German)

In a series of papers (Ann. Physik (6) 2, 292, 305; 3, 305; 4, 46, 90(1948); 6, 365(1949); Z. Physik 126, 734, 749(1949)) the authors have shown how the treatment of any wave-mechanical problem can be considerably simplified by the use of the Laplace transform. In the present work the method is applied to a calculation of matrix elements, i.e., to an evaluation of integrals involving eigenfuctions. In the example treated the latter are radial wave functions of the hydrogen atom.

1985

CONFIGURATION TRANSFORMATIONS AND FLUCTUATIONS OF STATIONARY QUANTIZED FIELDS. José A. Balseiro. Rev. union mat. Argentina 14, No. 5, 406-24 (1950). (In Spanish)

The problem of completely describing stationary particle fields by an orthonormal system of solutions when an original configuration is given by another orthonormal system of solutions is discussed. This is a problem of a stationary field of particles traversing, without appreciable absorption, an instrument, as, e.g., passage of radiation through an optical system or the motion of charged particles in a mass spectrometer. By taking into account fluctuation phenomena, expressions are obtained that are analogous to those of fields in a thermodynamic equilibrium.

1986

FURTHER REMARKS ON THE OPERATOR S(σ) OF DYSON-FEYMNAN. B. Ferretti. Nuovo cimento (9) 7, 783-5(1950) Sept. 25. (Letter to the editor; in Italian)

It has been observed in a previous note (Nuovo cimento (9) 7, 79(1950)) that for the case of a continuous energy-eigenvalue spectrum the operator S(σ) of Dyson (Phys. Rev. 75, 486(1949)) can be considered as a generator of a canonical transformation that diagonalizes the Hamiltonian of the free fields. Although an extension of that view to the case of discrete eigenvalues seems desirable, it is shown here that such a generalization would require a preliminary theoretical treatment.

1987

GRAVITATIONAL RADIATION FRICTION. D. D. Ivanenko and A. M. Brodskiĭ. Doklady Akad. Nauk S.S.S.R. 75, 519-22(1950) Dec. 1. (In Russian)

It has been qualitatively shown by one of the authors (Ivanenko, Uspekhi Fiz. Nauk 32, No. 2, 3(1947)) that, besides electromagnetic and meson frictions, there must exist a gravitational radiation friction that should be taken into account when formulating equations of motion of a single particle. These considerations are developed here and, in the framework of the classical theory, a computation is made of the deceleration produced by the radiation of gravitational waves in the case of a point particle; the approximation used can be called half-relativistic. The equation of motion employed is the equation of a geodetic line in a space distorted by its own gravitational field which is assumed to be weak and obeying Einstein's equations in a linear approximation. It may be noted that such an approach is applicable to other problems of gravitation, such as that of the gravitational vacuum.

1988

INTERNAL CONVERSION OF γ RAYS WITH GENERATION OF PAIRS IN LIGHT ELEMENTS. V. B. Berestetskiĭ and I. M. Shmushkevich. Zhur. Eksptl'. i Teoret. Fiz. 20, 574-6(1950) June. (Letter to the editor; in Russian)

In a recent paper on internal conversion with pair generation (Zhur. Eksptl'. i Teoret. Fiz. 19, 597(1949)), the authors derived formulas for the differential conversion coefficients of magnetic and electric multipoles corresponding to an emission of a positron. Since the integrals giving the total conversion coefficient could not be expressed by elementary functions, results of a numerical integration are given here. They agree with similar data published later by Rose (Phys. Rev. 76, 678(1949)).

1989

MAGNETIC MOMENTS OF ELEMENTARY PARTICLES OF HIGH SPIN. A.-W. Maue. Z. Physik 128, 378-86(1950) Oct. 3. (In German)

In the framework of the fusion theory of de Broglie, magnetic moments of elementary particles of the fusion stage 3 are calculated. (auth)

1990

MASS- AND CHARGE-RENORMALIZATIONS IN QUANTUM ELECTRODYNAMICS WITHOUT USE OF THE INTERACTION. G. Källén. Arkiv Fysik 2, No. 2, 187-94(1950).

The differential equations of quantum electrodynamics are solved in a few special cases without use of the interaction representation of Tomonaga and Schwinger. The results agree with those obtained earlier, and the calculations are, at least in the problems treated here, somewhat simpler than before. It may thus be pointed out that the mass and charge renormalizations can be carried out without any reference to a system of space-like surfaces. This is especially convenient when particles of integral spin are present, as the interaction operator of Schwinger then contains the normal unit vectors of these surfaces. The end formulas, however, must be independent of the normals. (auth)

1991

A NEW METHOD FOR THE TREATMENT OF LONGITUDINAL AND SCALAR PHOTONS. K. Bleuler. Helv. Phys. Acta 23, 567-86(1950) Sept. 1. (In German)

Gupta (Proc. Phys. Soc. (London) 63, 681(1950)) has introduced a method of quantization of the Maxwell field which differs from the usual one in that the scalar part of the field is quantized by means of the indefinite metric of Dirac. It is shown that this method can be extended into a general and consistent theory, including the case of interaction with electrons. Some of the advantages of the new method are the following: The well-known difficulty of normalizing a state vector satisfying the Lorentz condition no longer occurs. For processes taking place within long time intervals the photon vacuum can consistently be stated in the form $A_\mu^+(x)\psi_0 = 0$, proposed by Schwinger (Phys. Rev. 74, 1439 (1948); 75, 651(1949)), a condition that could not be fulfilled in the ordinary theory. Gauge invariance is exhibited in a peculiarly direct way. It is shown, by a canonical transformation, that the theory is equivalent to the reduced one where the longitudinal field is eliminated and replaced by the static Coulomb interaction. All physical results are therefore identical with those of the ordinary theory. The Lorentz invariance is exhibited in a simple way. (auth)

1992

NOTE ON THE RELATION BETWEEN FEYNMAN'S FORMULATION OF SCATTERING PROBLEMS AND THE BORN APPROXIMATION. J. R. H. Dempster. Can. J. Phys. 29, 66-71(1951) Jan.

Feynman's formulation of scattering problems is described briefly, and is compared with Born's approximation. The two procedures are shown to be equivalent and to be valid

under the same conditions. Feynman's formulas are used to calculate the first- and second-order terms of the scattered-particle wave function, with an arbitrary scattering potential. (auth)

1993

ON THE GRAVITATIONAL PERTURBATION FOR THE DIRAC ELECTRON. Hideo Yamamoto. Mem. Coll. Sci. Univ. Kyoto 22A, 225-36(1939) July.

A study is reported of a quantum gravitational problem which might be reduced to a perturbation problem for the stationary state of the Dirac electron by means of the generalized wave equations in the tensor forms. (auth)

1994

ON THE THERMODYNAMICS OF THE BOSE GAS. Yu. B. Rumer. Zhur. Eksptl'. i Teoret. Fiz. 20, 807-10(1950) Sept. (In Russian)

Starting with more general assumptions on the energy spectrum than are generally used, a study is made of the phenomenon of "condensation" of the Bose gas and of the influence of external parameters on the temperature of the "condensation." (auth)

1995

ON THE USE OF β-FORMALISM OF THE MESON FIELD FOR NUCLEAR INTERACTIONS. Vachaspati. Proc. Phys. Soc. (London) 63A, 1015-28(1950) Sept. 1.

Following a method due to Harish-Chandra (Phys. Rev. 71, 793(1947) and Proc. Roy. Soc. (London) 192A, 195(1948)), a correspondence between the Proca and the β formalisms of the meson field theory is developed. An important feature of the method is that one can at any stage of calculations pass over from one formalism to the other. No explicit representation of the β matrices is required nor need one know the exact relationship between the elements of the wave function ψ and the Proca field quantities U_μ and $G_{\mu\nu}$. This introduces considerable simplification in the introduction of nuclear interaction as compared with earlier treatments where one has to choose a special explicit representation of the β_μ's and identify the various elements of the matrix ψ with the components of U_μ and $G_{\mu\nu}$. As an illustration of the method, the scattering of positively charged mesons by protons is calculated.

1996

PRINCIPLES UNDERLYING APPROXIMATE CALCULATIONS OF ELECTROMAGNETIC OSCILLATIONS IN A VACUUM. Hans J. Mähli. Helv. Phys. Acta 23, 864-5 (1950) Dec. 10. (Note; in German)

If an exact solution of an eigenvalue problem can be expected, the latter is best formulated as a differential equation with accompanying boundary conditions. If, however, one has to resort to approximations, the most advantageous formulation is that of a variation problem. This is illustrated in the case of electromagnetic oscillations in an evacuated space surrounded by an ideal conductor.

1997

REMARKS ON A SOLUTION OF THE WAVE EQUATION. Antonine Visconti. Compt. rend. 231, 507-9(1950) Sept. 4. (In French)

An exact solution of the wave equation of a perturbed system is discussed. By considering the diffusion of a perturbing wave in the perturbation domain, the author shows that it is possible to write directly the wave function without using the wave equation, by considering only a de Broglie wave upon which is imposed a law of diffusion. This concept is applied to the theory of the positron.

1998

SECOND-DEGREE RADIATIVE PROCESSES. Cecilia Mossin Kotin. Rev. union mat. Argentina 14, No. 5, 323-31 (1950). (In Spanish)

The computation of transition probabilities for radiative processes can be considerably simplified by the use of the hypercomplex formalism, which accounts immediately for all intermediate states due to different spin orientations and charge signs. As an example, the case of two-photon and two-electron states is considered, involving both the Klein-Nishina formula for Compton scattering and Dirac's formula for pair annihilation. (auth)

1999

SECOND ORDER CURRENT CORRECTIONS FOR BOSON FIELDS. D. C. Peaslee. Helv. Phys. Acta 23, 490-2(1950) Sept. 1.

The current correction to second order in the electric charge has been computed for scalar and vector mesons in the presence of a virtual electromagnetic field. The divergence features of the expression are compared with those in the electron case.

2000

THE THEORETICAL BEHAVIOR OF A MAGNETIC MONOPOLE IN A WILSON CLOUD CHAMBER. H. J. D. Cole. Proc. Cambridge Phil. Soc. 47, Part 1, 196-206(1951) Jan.

Dirac has suggested that the quantization of electric charge could be explained by the existence of magnetic monopoles. In view of this hypothesis, this paper investigates what theoretically would be the behavior of such monopoles in a Wilson cloud chamber. The treatment, which for simplicity is basically classical, closely follows Bohr's work on the decrease of velocity and ionization properties of α and β particles, and expressions are derived for the rate of decrease of energy and the number of ion-pairs produced per centimeter by a monopole passing through a gas. These expressions are then discussed with particular reference to the case of heavy particles, and the main differences between them and the corresponding expressions for α particles both as to range and ionization are indicated; these differences can be summarized by saying that monopoles have much shorter paths, but create many more ion-pairs per centimeter than α particles. Also, the very sharp increase in the ionization at the end of the path of an electric particle is missing, the ionization for the monopole decreasing to a small amount near the end of the path. (auth)

2001

VARIATION PRINCIPLE AND CONSERVATION EQUATIONS IN NON-LOCAL FIELD THEORY. Claude Bloch. Kgl. Danske Videnskab. Selskab, Mat. fys. Medd. 26, No. 1, 1-30 (1950)

An interpretation of the nonlocal fields introduced by H. Yukawa is given by means of a rule associating any nonlocal quantity with a corresponding density, which is an ordinary function of space and time. It is shown that, in the spirit of this interpretation, the field equations can be deduced from a variation principle. Conservation equations follow from the invariance properties of the Lagrange function. It appears that a collision process must be regarded as a whole in accordance with the ideas of the S-matrix theory. Application is made of these principles to the free fields of spin 0 and ½, and the second quantization is introduced. It is shown in particular that, with the proposed interpretation, no physical meaning can be attached to the solutions of the field equations with "internal rotation" described by H. Yukawa. A Lorentz invariant supplementary equation excluding these extra solutions is established. (auth)

2002

THE VARIATION PRINCIPLE IN PROBLEMS OF TIME-DEPENDENT POTENTIALS. M. Cini and L. A. Radicati. Nuovo cimento (9) 7, 905-10(1950) Nov. 20. (In Italian)

The variational method developed by Schwinger for the treatment of scattering problems is extended so as to include the case of a time-dependent potential. The transition amplitude from an initial to an arbitrary final state is shown to be stationary. The time-dependent case is easily derived from this more general principle. (auth)

TRACER APPLICATIONS

2003

TELEMETERING SYSTEM FOR RADIOACTIVE SNOW GAGE. John A. Doremus. Electronics 24, 88-91(1951) Feb.

Snowfall in isolated mountain areas is measured in terms of radiation between a source of Co^{60} embedded in the ground and a G-M tube suspended above it. Unattended f-m transmitters and repeaters forward data to a central recording station. Commitments for hydroelectric power and irrigation water are made on a basis of these measurements. The telemetering system, calibration, errors, and future developments are discussed.